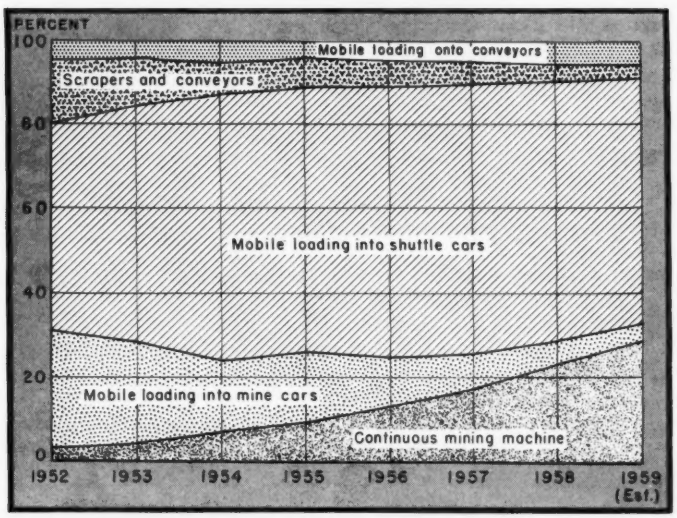
MINING CONGRESS JOURNAL

MAY 1960



Sixty-four ton hauler at Eagle Mountain . . . . p. 44



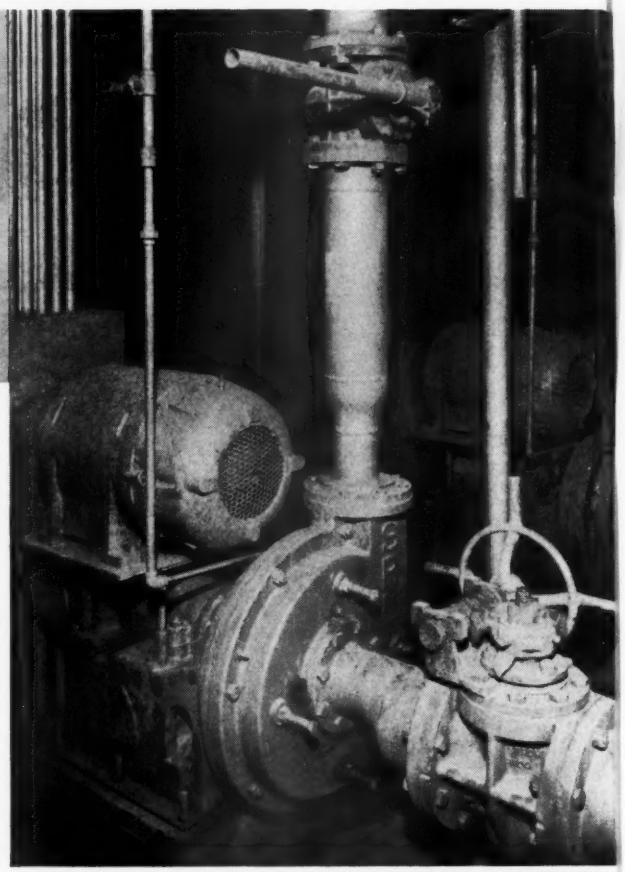
Trend in underground coal mining methods . . . p. 38



Radar finds a place in surveying . . . . . p. 55

Here are the "dollars and cents" reasons why the trend is to

DENVER SRL PUMPS



- ***SRL Pumps (and Parts) Cost Less—Last Longer***

  Quantity production makes DENVER SRL Pumps the lowest priced and highest quality molded rubber lined pumps on the market. Prices are so low that no operator can afford any pump service less than that of DENVER SRL Pumps. Parts cost less and last longer because casing liners and runners are made of specification rubber, pressure-molded to metal for longest wear, lowest maintenance. Rubber parts last up to 15 times longer than the best hard iron or alloy steel. Means fewer shutdowns... less down time.

- ***SRL Pumps Save up to 50% Horsepower***

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- ***STOP PAYING FOR HIGH COST PUMPING***

  A DENVER SRL Pump will pay you when it replaces an iron pump on abrasive service. Try it out at our guarantee and put your savings in the bank!

CAPACITY TO 5000 G.P.M.

SPECIFICATIONS AND DIMENSIONS

Pump Size and Type	Capacity 60' Head RPM	HP	*Water GPM	Dimensions (In.) L	W	H	Approx. ship wt. lbs.
1½"x1¼"	2190	1.9	40	24	17½	23	525
2½"x2"	1500	4.9	160	25½	17½	26⅜	575
3" x3"	1400	6.8	260	31¼	19¾	31½	850
5" x5"	1060	17.4	800	37¾	26¼	36½	1550
6" x6"	1170	36.3	1600	45¼	28½	46½	2300
3" x3"—C	1450	8.2	260	37½	21½	33¾	1240
5" x4"—C	1035	12.6	700	40¼	27	37⅜	1600
8" x6"—C	920	39.8	1600	63	36½	49¼	4375
10" x8"—C	820	74.0	3300	68¾	43	57	5100
12" x10"—C	615	115.0	5000	69⅝	46½	63	5900

*Based on water. Multiply horsepower by specific gravity of pulp to obtain actual brake horsepower.



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VOL. 46 MAY 1960 NO. 5

CONTENTS

Opinions expressed by the authors within these pages are their own and do not necessarily represent those of the American Mining Congress.

ARTICLES

Modernization of a Gypsum Operation — 34
Robert B. Jordan

Productivity of Continuous and Conventional Mining Equipment — 38
R. L. Anderson

Large Truck Haulage at Eagle Mountain Mine — 44
Martin J. Hughes

Lock Washers Indicate Roof Bolt Tension — 48
AMC Roof Action Committee

Flotation of Some Oxidized and Nonmetallic Ores — 50
William C. Aitkenhead and John A. Jaekel

Electronics in Modern Aerial Mapping — 55
George L. Hess

Sinking a Small Concrete-Lined Shaft in Wyoming — 58
Ken Nobs

Silicon Rectifiers for Mining Service — 60
Ralph Edward Wahl

Viewpoints on Safety
Part I — Getting Proper Attitude to the Working Face — 66
Donald E. Wilson

Diesel-Electric Truck — 68

Roof Support — Follow Your Timbering Line — 69

DEPARTMENTS

Editorials — 33

Operators Corner — 70

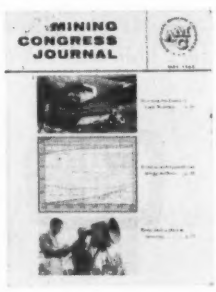
Wheels of Government — 73

News and Views — 81

Manufacturers Forum — 89

ON OUR COVER

Views on the cover highlight three articles in this issue . . . (top) eight-yd shovel working with 64-ton truck provides efficient and low cost operation — (middle) breakdown of total mechanically loaded output at underground bituminous and lignite mines in the United States by method of mining and loading, 1952-59 — (bottom) one of the newer electronic devices being used to cut cost and time in field surveys.



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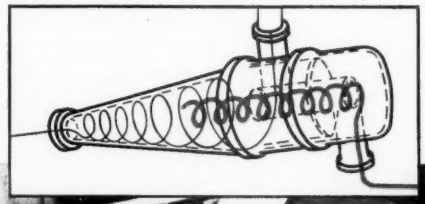
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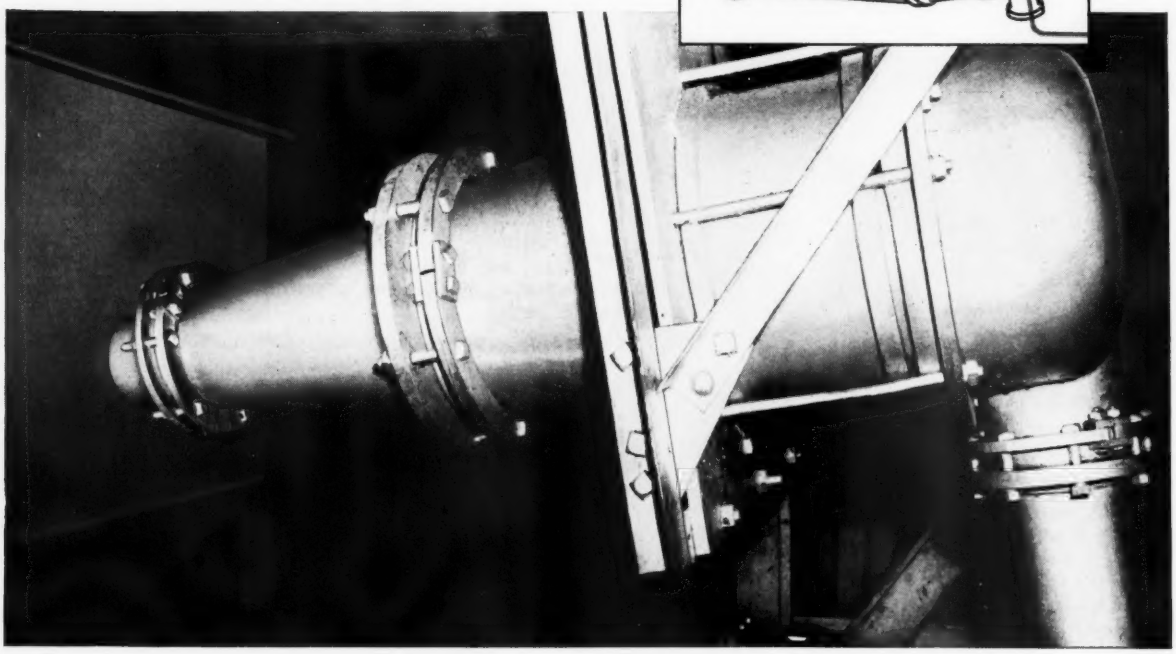
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A new era in fine coal cleaning in the United States has been inaugurated with installations by Roberts & Schaefer of the Dutch State Mines Heavy Medium Cyclone Washing System.

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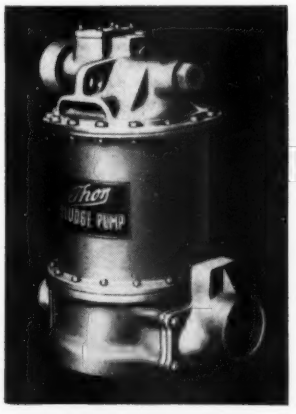
Everything you want in Air Sump Pumps· · ·

and more!

For water removal get the best—Thor Sump Pumps. Model 51T delivers 200 gallons per minute at 10 ft. head. Weighs 35¾ lbs. Lightweight (18 lbs.) aluminum model 51TA available. Heavy duty model 71T, in steel or bronze, delivers 460 gallons per minute at 10 ft. head. Model 381T delivers 125 gallons per minute at 110 ft. Your Thor "Red Tool" distributor will demonstrate. Thor Power Tool Co., Aurora, Ill. Branches in all principal cities.



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Thor

Everything you want in Air Sludge Pumps . . . *and more!*

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ROOF BOLTING THAT INCREASES PRODUCTION

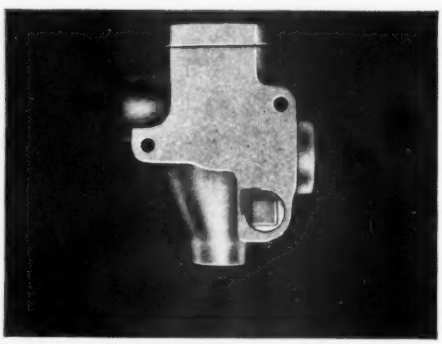


The ACME Model HSJ-4WD Jumbolter can work an area 23′ 10″ wide without moving. The air-articulated arms reach out 9′ in front of the machine. Each arm operates independently and swings 270 degrees.

with ACME 4 WHEEL DRIVE A.C. or D.C. JUMBOLTER

The versatile ACME Model HSJ-4WD Jumbolter, equipped with tractor-type 4 WHEEL DRIVE, insures minimum turning radius. Left hand and right hand wheels are integrated units. By reversing the wheels on one side while driving forward on the other side the ACME JUMBOLTER will turn in its own approximate diagonal.

This unit, now successfully operating under a variety of conditions, permits bolting in a wide flexible pattern from 8 to 10 feet back of the working face.



An Easy Way to SAVE DOLLARS on Your Air Supply

ACME'S new dust collector shut-off valve stops the operation of the dust collector when the stopers are idle between steel changes, etc. Controlled from the throttle valve of the stoper this simple, mechanical, fully automatic valve synchronizes the operation of the drill and the dust collector. It can be easily installed on your present Le Roi dust collecting system and will substantially lower operator fatigue by eliminating unnecessary dust collector noise. Designated the Model APC-77, the valve is modest in cost.

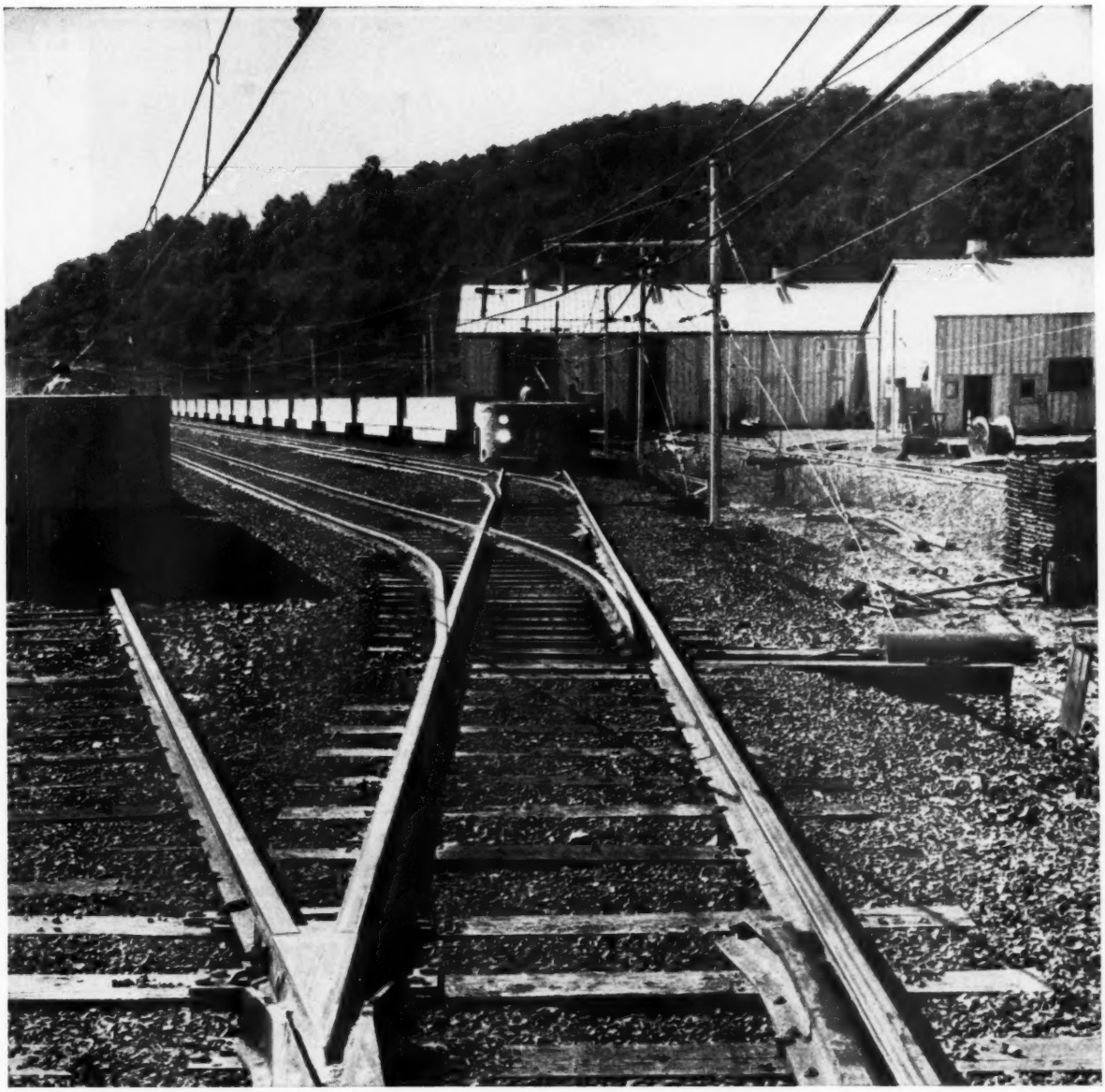
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Traffic moves on track like this

The owners of this progressive West Virginia mine planned their trackwork with the aid of Bethlehem engineers widely experienced in mine-track design and fabrication.

These turnouts furnish a good example of the kind of results they got (and you can get, too) by handing Bethlehem the job. Notice the big, heavy rail, the smoothly flowing curves, the snugly fitting points. Traffic can keep moving surely and steadily on trackwork like this!

Bethlehem track specialists welcome a challenge of this kind, and they are well-equipped to meet it. They study the situation thoroughly, draw up plans for approval, then turn in the design for fabrication. Before the finished track ever sees a mine, it will have been completely pre-assembled on our layout floors to be sure of perfect fitting.

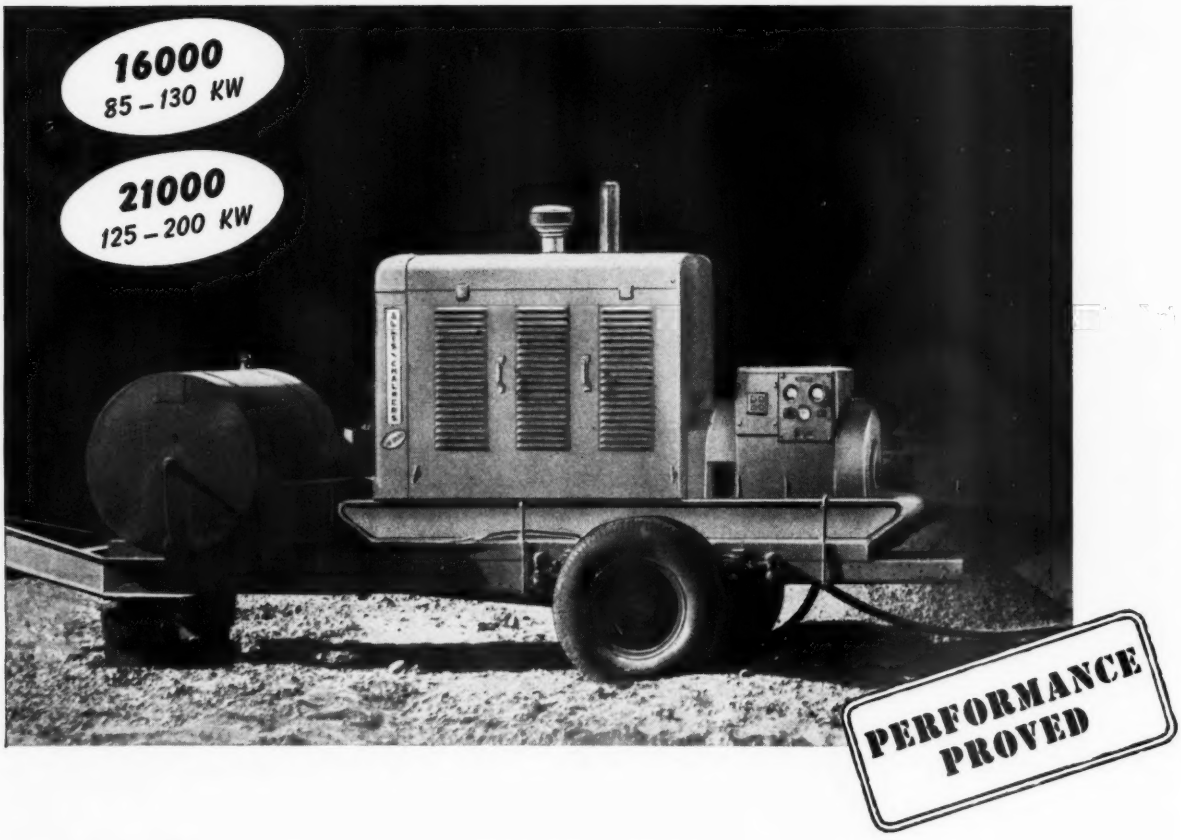
Best of all, the long-range cost of Bethlehem trackwork comes to a pittance, thanks to operating economies. A Bethlehem mine-track engineeer will be glad to discuss details with you any time you say. You can reach him through the nearest Bethlehem office, or by writing to the address below.

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Can save $3,000 a year on fuel alone — Users tell us the 21000 turbocharged diesel saves as much as 2½ gal. of fuel in every 10 compared with other engines, or 1 to 4 gallons for every hour of operation.

"Startingest engine we ever had," says a northern user. "We threw away the ether can with temperatures way down below freezing — no external heating either." With their unique controlled combustion, these engines start and pick up loads in 4 to 10 seconds.

Safe in dusty, corrosive or explosive atmospheres — Brushless generators have new simplicity. There are no slip rings, no brushes, no commutators to wear or to spark. They are replaced by newly developed, non-aging silicon rectifiers that rotate with the armature.

Precisely regulated power — New Allis-Chalmers magnetic amplifier type static voltage regulator has no moving parts or contacts, no parts to burn or wear. There's unequaled fast response to sudden changes in load — heavy motor starting loads are easily picked up.

Allis-Chalmers manufactures and stands behind all four major components. This means coordinated engineering, matched performance, undivided responsibility — an Allis-Chalmers exclusive. Sets are simple, unit-type, self-contained — mounted on husky skids. No special foundation required, no danger of misalignment. Electrical connections are simplified to speed installation and reduce related costs. See your dealer for more about these outstanding 16000 and 21000 sets. Allis-Chalmers, Milwaukee 1, Wisconsin.

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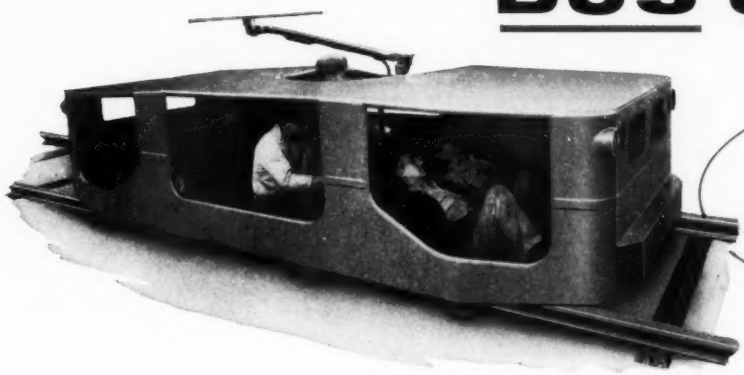
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coming and going

you take your profits on ~~the~~ every run with the Lee-Norse

BUS & JITNEY



Lee-Norse
MINE PORTAL BUS

■ There's no wasted motion with this self-propelled Portal Bus because it is fast on the take-off, saving manpower time for conversion into more tonnage. And it is designed for safety, with hydraulic operated running brakes plus mechanical emergency and parking brakes direct on the wheels. For severe grades, optional electric dynamic system produces braking effect from the motor for *extra* safety under all conditions. Also the split roof construction gives operator unimpeded, all directional view, while the trolley pole is always within quick reach. This bus is powered by 15 H.P. motor and will haul 13 to 17 men.

Lee-Norse
MINE JITNEY



■ The Mine Jitney is the "Jack-of-all-Trades" of the mine fleet because its versatility enables it to be used on the regular job and for emergency. It can handle the job of furnishing fast, safe transportation of key personnel, maintenance crews and special groups; and can double up as an ambulance or fire-fighting equipment car. Designed with twin braking systems for added safety. Powered with either 5 or 7½ H.P. motor. Holds up to 7 men comfortably. Optional equipment: Plexiglas windshield, fire extinguisher, stretcher equipment.

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How these exclusive LW Haulpak® advantages... help you

HYDRAIR* smooths rough haul roads

On the LeTourneau-Westinghouse Haulpak, you get a sturdy, simple air-hydraulic suspension system that completely eliminates the costly, time-wasting maintenance and repair of leaf springs. Four Hydrair units cushion against loading and travel shock... compensate automatically for off-center loading and keep the load riding level over humps and holes.

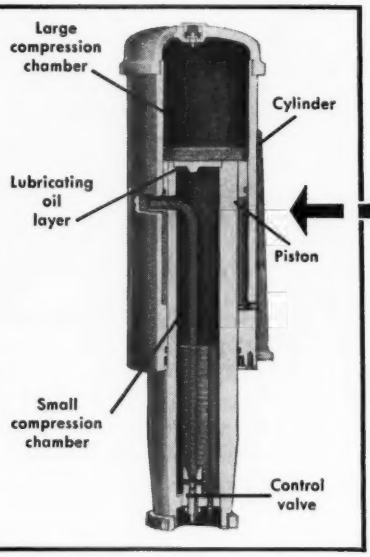
Other Hydrair benefits:

Located high out of dust, dirt, and moisture, Hydrair cylinders permit higher ground clearance (25″) and sharper turning (Haulpak makes continuous 180° turn in area only 44′6″ wide). The elimination of springs and conventional front axle also reduces non-profitable dead-weight.

How this exclusive suspension system works

Basically, Hydrair operates like this: The upper compression chamber above the piston supports the load on a cushion of nitrogen gas and the lower compression chamber acts as a rebound chamber to snub the return or downward movement of the piston. The maximum stroke of the piston is 14 inches in the two front suspension units and as much as 7 to 9 inches in the two rear Hydrair units.

Conventional leaf springs have an "action space" of less than 4 inches, so it is easy to judge the tremendous improvement Hydrair represents as far as tire and vehicle life and operator comfort are concerned. Hydrair absorbs and cushions virtually all loading and travel shock, keeping this brutal punishment away from the tires, structure, and operator. Hydrair relieves the pounding on the road surface that creates "washboards".

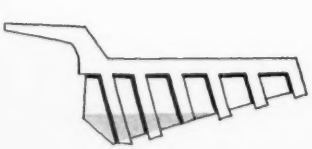


DEEP V-BODY gives you bonus tonnage within short wheelbase



Haulpak's exclusive deep V-body allows you to haul extra tons of material within a short wheelbase. Loaded material quickly fills all corners for big, low-void payloads. Deep "V" also provides a low center of gravity... gives Haulpak better stability on turns for high-speed hauling no matter how rugged the road.

In addition, the Haulpak V-body is exceptionally strong. It is constructed of high-tensile-strength steel... nearly 3 times stronger than steel commonly used in trucks, yet it weighs ⅓ less. Result: You haul up to 30% more payload than Haulpak's weight.



Bonus yardage in every Haulpak load rides in the exclusive V-shaped body. Low loading height (10′1″) and large top opening (14′5″ x 11′) makes it easy for shovel operators to load Haulpak fast, without spillage. Heavy rubber pads provide 100% cushioning of the body against loading and travel shock.

*Trademark HP-2293-G-2

cut hauling costs

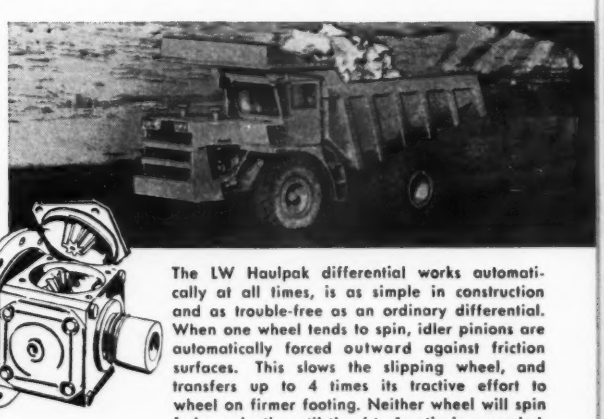


POWER-TRANSFER DIFFERENTIAL
pulls load through soft footing

This same exclusive LW differential has boosted production and cut costs for thousands of LW Tournapull® owners for more than 14 years . . . and now, for the first time, it is available on a truck. The power-transfer differential automatically puts power on the wheel with best traction, so you can haul through soft, slippery spots that bog down conventional haulers. The differential action also reduces wheelspin and tire wear.

HAULPAK saves you money many other ways

LESS MAINTENANCE (entire lube-check, needed only at 500-hr intervals, consists of just 4 easy-to-reach grease fittings). POWER-MISER FAN (cools with 20 to 25 less hp drain). FOUR SEPARATE BRAKING SYSTEMS (for fast stops with complete safety). POSITIVE POWER STEER (for faster turning, easier handling). SIMPLE SIX-GEAR FINAL DRIVE (compared to 12 or more usually standard). *We will give you complete information.*



The LW Haulpak differential works automatically at all times, is as simple in construction and as trouble-free as an ordinary differential. When one wheel tends to spin, idler pinions are automatically forced outward against friction surfaces. This slows the slipping wheel, and transfers up to 4 times its tractive effort to wheel on firmer footing. Neither wheel will spin independently until the 4-to-1 ratio is exceeded.

LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

the DOWTY *Roofmaster*
. . . now underground in Pennsylvania!



400 ft. longwall face mined with fully mechanized
"PUSH BUTTON" ROOF CONTROL *system*

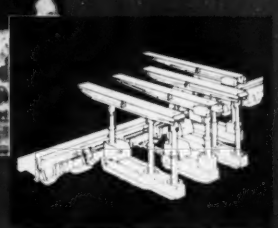
The DOWTY *Roofmaster* is now making *practical* all the "theoretical" advantages of *longwall mining* . . . positive, continuous operations . . . no moving from place to place . . . concentration of output and haulage . . . simplicity of ventilation . . . *high output per man and low cost per ton.*

The new production-boosting *Roofmaster* system is now operating on a 400-ft. longwall coal face in Central Pennsylvania. It is a self-advancing, hydraulic-powered roof support system used with a shearer continuous miner and snaking conveyor.

With the *Roofmaster* system, *all functions* of roof control on the longwall face are performed by two men! The total face crew of five to seven men is expected to produce 600 or more tons of coal per shift on a 3½-ft. seam.

Conditions throughout bituminous areas are favorable for conversion to longwall with the DOWTY *Roofmaster* system. Greater production — greater safety — greater profits . . . these are the rich rewards attainable.

Skilled and experienced DOWTY engineers are available to survey the longwall potential of your mine, and provide comprehensive reports without obligation.



The DOWTY Roofmaster consists of self-advancing, hydraulic-powered double and triple-prop support units. Only two men are required for continuous operation of 200 support units.

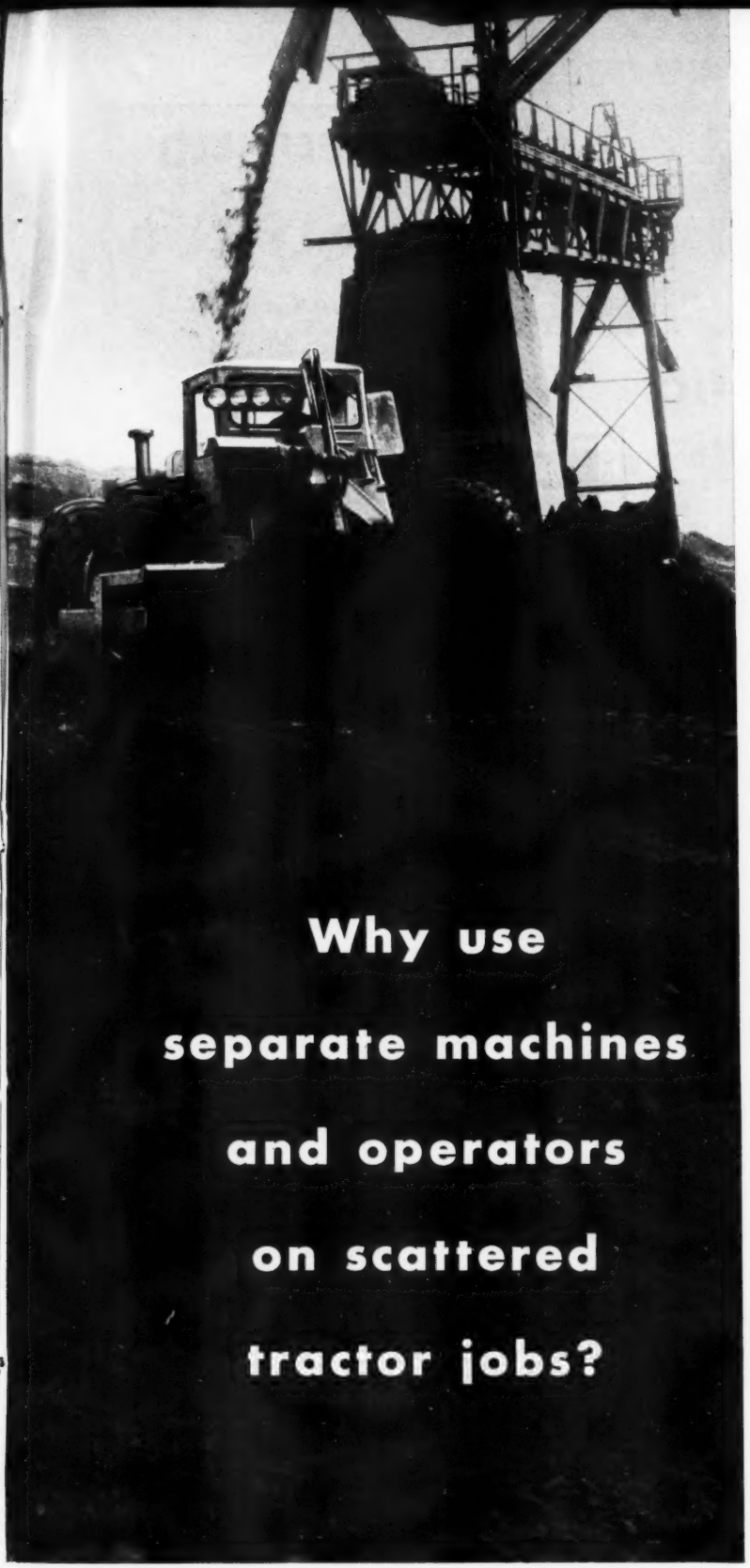
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"Dowty Service Is Your Guarantee"



Why use separate machines and operators on scattered tractor jobs?

Handle your widely-separated pit maintenance and clean-up jobs swiftly and economically with one man and a LeTourneau-Westinghouse Tournatractor®. This rubber-tired tractor speeds to the job under its own power . . . over paved roads, down shot-banks, cross-country or over railroad tracks. There are no delays while tractor crawls to new locations.

LW tractor gives you better speed at the work area, too. Acceleration is fast, with 218-hp operating through sealed anti-friction drive. Maneuverability is quick and easy. Also, there's no loss of momentum to shift gears, because this tractor's gears are constantly in mesh. Even reverse action is *instant*.

Handles wide variety of jobs

You can use just one Tournatractor to clean-up around 2 or more shovels . . . and at the same time maintain stock-piles, level waste dumps, clean debris off RR tracks, clean benches, handle shallow stripping, tow air-compressors, or pull supply and service wagons. You can even use this speedy, mobile tractor for maintenance and clean-up in one or more adjoining pits.

Biggest tractor value today!

In addition to giving you these plus operating advantages, LeTourneau-Westinghouse Tournatractor *costs less* to own, and *much less* to maintain than a track-type tractor of comparable horsepower. Let us demonstrate this rubber-tired tractor at your pit. Watch Tournatractor perform under *your* working conditions. You'll find it can handle scattered tractor jobs faster, more efficiently, to help cut your tractor costs.

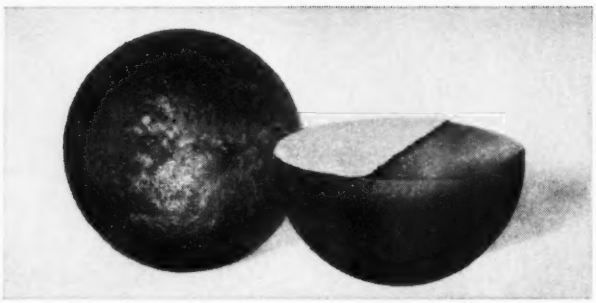
◀ Powerful LW Tournatractor spreads and compacts conveyor-dumped mineral-bearing soil. At this plant, mobile rubber-tired tractor also pulls rail cars, handles dump maintenance, and operates a towed scraper.

CT-2101-MQI-1

LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



SHEFFIELD

MOLY-COP

COPPER-MOLYBDENUM-ALLOY

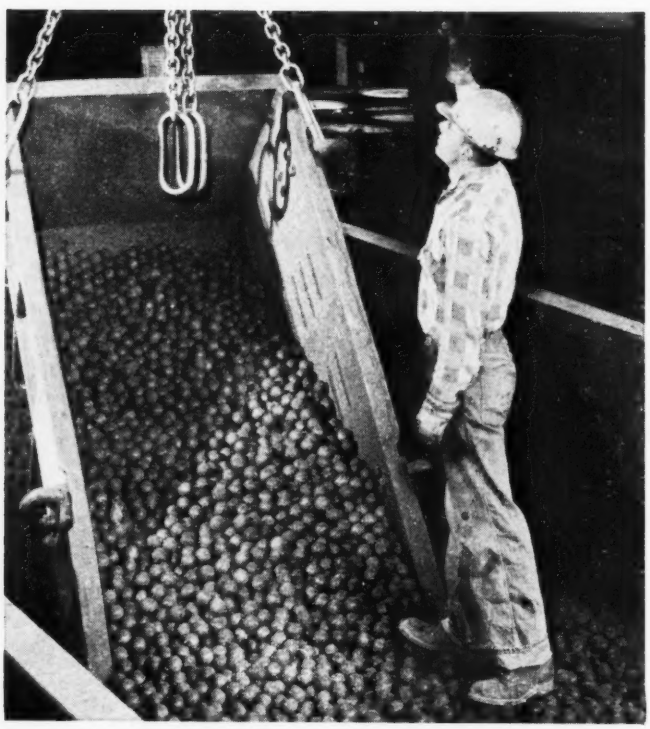
Grinding Balls

consistently

UNIFORM

hardness at the surface

. . . toughness to the core



Moly-Cop Balls will give you better grinding at lower cost. What's behind this fine performance? Hardness, toughness and uniformity. Hardness to fight wear. Toughness to resist spalling and breaking. And uniformity of fine grain structure right to the core. Result: Moly-Cops keep their spherical shape longer. Fewer chargings. Less down time. Money saved.

The Standard of Comparison Around the World

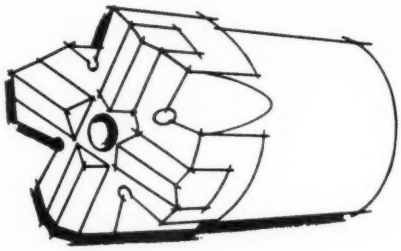
New steels are born at Armco

SHEFFIELD DIVISION

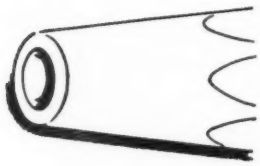
Sheffield Plants in Kansas City, Tulsa and Houston

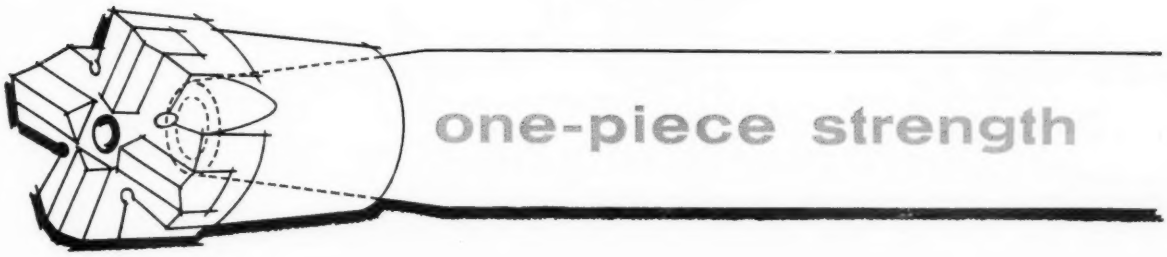
ARMCO STEEL CORPORATION

OTHER DIVISIONS AND SUBSIDIARIES: Armco Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products



This removable bit gives





one-piece strength

---cuts air-leg drilling costs

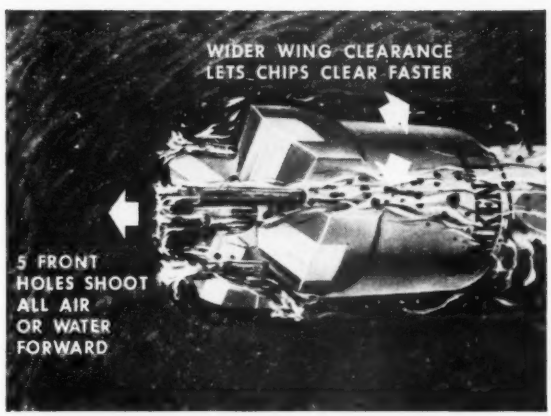
ONE big reason Timken® tapered socket bits save you money is—you don't have to throw away good drill steels after the carbides wear out as you do with intra-sets. Timken bits are removable—yet have one-piece strength. You can keep on using good steels.

And those Timken bits save you even more because only a pocketful are needed for a day's work. Compare that to lugging an armful of intra-sets to the mine face.

Still another reason: with Timken bits you can change bit gauge sizes fast on the same steel. No changing the whole steel.

What's more, *only* the bit itself need go in for resharpening. You don't have to haul the whole steel. And Timken bits give longer gauge wear because there are four cutting edges. Most intra-sets have only two.

Add them all up and see why you'll cut your drilling costs with the TTC—air-leg bit that's tapered for one-piece strength—made of tough, Timken fine alloy steel for longer life. The bit that clears chips faster as the diagram at right shows. Send for free brochure, "Timken Removable Rock Bits". The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.



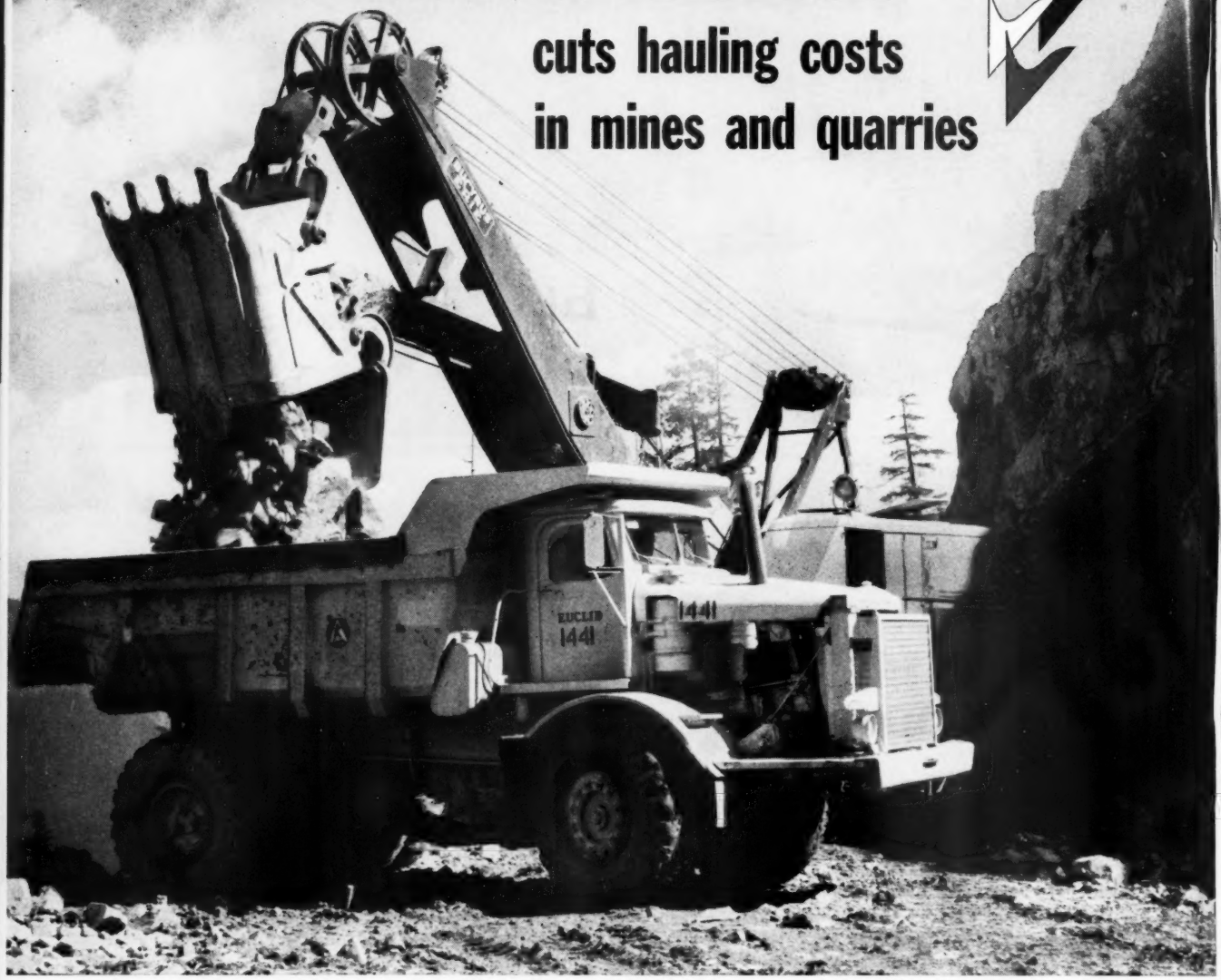
FASTER CHIP CLEARANCE because five front holes shoot air or water directly against the rock face. And deeper, wider wing clearance lets chips wash back faster.

TIMKEN®

removable rock bits

EUCLID'S GREATER DIMENSION

cuts hauling costs in mines and quarries



Model R-27 has rated payload of 54,000 lbs. and a heaped capacity of 26½ yds. . . . available with Cummins 335 h.p. and GM 336 h.p. engine . . . 4-speed Torqmatic Drive with converter lock-up and Torqmatic Brake . . . dual hydraulic booster steering . . . 18.00 x 25 tires on all wheels . . . rugged body with twin hoists . . . top speed with full payload, 34 mph.

Backed by better than 25 years of specialized experience in building off-highway earthmoving equipment exclusively, Euclid's modern rear-dump line incorporates advanced engineering that is a result of unmatched field experience. From the 10-ton Model R-10 to the big 55-ton "Euc" with two engines and a total of 672 h.p., Euclid Rear-Dumps meet today's requirements for big performance.

This greater dimension . . . in a wide range of capacities, in choice of engines, transmissions, tire sizes, and in type of hauler . . . in the parts and service facilities of Euclid's world-wide dealer organization, too . . . can mean lower hauling costs on mine and quarry work.

EUCLID Division of General Motors, Cleveland 17, Ohio
Euclid (Great Britain) Ltd., Lanarkshire, Scotland

A complete line of rear-dumps with payload capacities of 10, 15, 18, 22, 27, 40 and 55 tons . . . also semi-trailer models of 12, 22, 35 and 50-ton capacity.

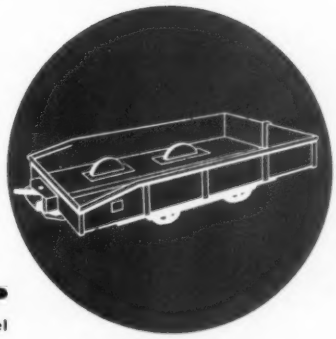
GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

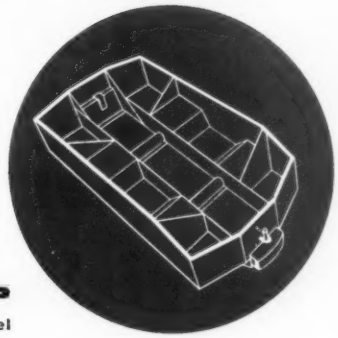
FOR MOVING EARTH, ROCK, COAL AND ORE



DROP BOTTOM
4 wheel or 8 wheel



END DUMP
4 wheel



ROTARY DUMP
4 wheel or 8 wheel

acf MAKES ALL THREE

No matter what type of car your mining operations call for **ACF** has a car to fit your needs. **ACF** mine cars are built in all types and sizes from 2 to 30 tons, or more.

For safety, low maintenance and high speed constant haulage all **ACF** mine cars have special features developed through many years of experience in design and manufacture.

Anti-friction bearings in the load-support wheels permit safe high speed from loading point to unloading point and back again for more. Automatic couplers make car handling safer and faster. **ACF** double-action spring bumpers lower maintenance on everything from trackage to locomotive...provide smoother, safer hauling.

For complete information about the full line of **ACF** Constant Haulage Mine Cars in all sizes and types contact the nearest **ACF** sales office or discuss your haulage problems with one of our sales representatives.

AMERICAN CAR AND FOUNDRY
Division of ACF Industries, Inc.
750 Third Avenue, N.Y. 17, N.Y.

SALES OFFICES:
NEW YORK
PHILADELPHIA
BERWICK, PA.
WASHINGTON, D.C.
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ST. LOUIS
SAN FRANCISCO

WHICH IS BEST
3 new series Cat Motor Graders

NEW
No. 12
Series E
115 HP

NEW
TURBOCHARGED
No. 112
Series F
100 HP

NEW
No. 112
Series E
85 HP

for higher production, easier servicing and long life!

No machine is better than its engine—and the new Cat Diesel Engines in these three new series Motor Graders are better than ever. They're more compact, more rugged and modern in design. They incorporate the latest developments in metallurgy and technology. They provide three important bonuses—greater lugging ability in tough going, easier servicing and long life.

A COMPLETE LINE—85 HP to 150 HP

The new Turbocharged 100 HP No. 112F is designed for high production to match work requirements between the new 85 HP No. 112E and new 115 HP No. 12E. Compared with the 85 HP model, the 100 HP machine delivers 5% higher travel speeds and a 5% increase in blade speed control. With its introduction into the line, Caterpillar now offers you a choice of four Motor Graders in all to meet your specific requirements. The largest is the Turbocharged 150 HP No. 14, the most versatile big grader ever developed.

SEE YOUR CATERPILLAR DEALER

Some of the features of the new Cat Motor Graders are described briefly here. But for the complete picture, see your Caterpillar Dealer. Ask him to show you how they're a better buy for your money than ever. Take a look under the hoods at the new modern-design engines. Better still, ask for a demonstration.

See how they "pull through" tough going.

Caterpillar Tractor Co., General Offices, Peoria, Ill.

CATERPILLAR

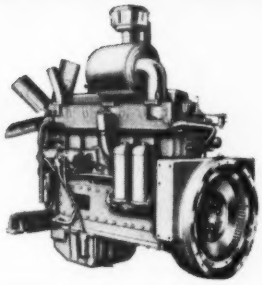
Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

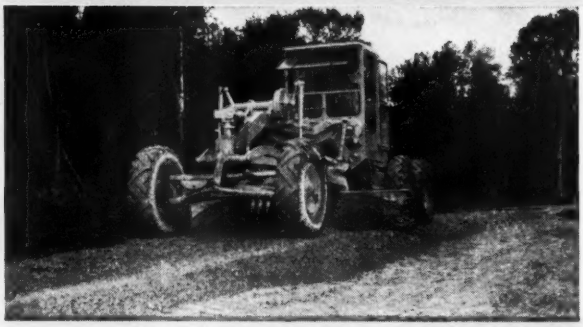
MODERN HEAVY-DUTY
MOTOR GRADERS
TO FIT ANY JOB

FOR YOUR JOB?
with new compact engines!



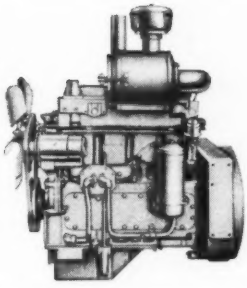
New No. 12E Motor Grader features new compact 115 HP Engine





New No. 112E Motor Grader features new compact 85 HP Engine

The new No. 112F is similar in appearance, but features a Turbocharged 100 HP Engine.

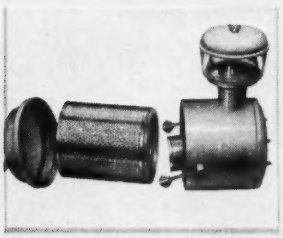


NEW HIGH TORQUE. Though the engines in the new Cat Motor Graders are designed specifically for each machine, they all develop higher torque than previous models and have other basic improvements in common. For example: shorter, stiffer blocks and crankshafts... stronger, distortion-resistant cylinder heads... improved cooling systems with greater capacity... engine lubricating oil conditioning... and advanced design fuel systems —new, compact fuel injection pumps with barrel and plunger assemblies in easy-to-service pump housings.

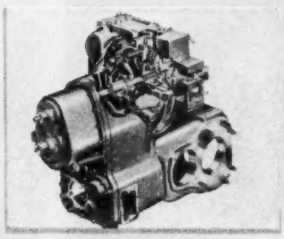
NEW STARTING ENGINE. Now standard is a new two-cylinder, vertical starting engine to replace the horizontal engine. All three Motor Graders use a modern 12-volt electric system. An optional 24-volt system is available for use in moderate climates where direct electric starting is practical.

PERFORMANCE-PROVED FEATURES. While many advances have been designed into the compact new engines, certain time-tested features have been retained. To mention a few: precombustion chamber design that delivers maximum horsepower on heavy, economy-type fuels... steel-back aluminum bearings... wet-type "Hi-Electro" hardened cylinder liners... and aluminum pistons with cast-in ring band.

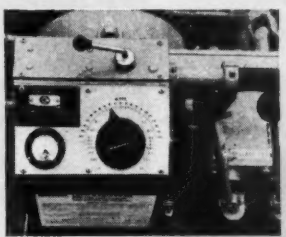
OTHER HIGH-PRODUCTION FEATURES IN CAT MOTOR GRADERS



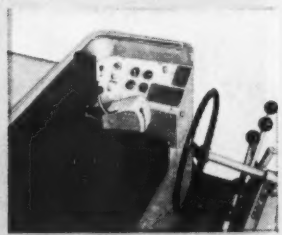
NEW DRY-TYPE AIR CLEANER (standard) removes a minimum of 99.8% of all dirt from intake air during every service hour. Can be serviced in 5 minutes. Cuts your maintenance time by as much as 70% and substantially reduces maintenance costs. Cleaner air also extends engine life.



EXCLUSIVE OIL CLUTCH (standard) provides up to 2000 hours service without adjustment, the equivalent of about 12 months of "adjustment-free" operation. A Caterpillar development proved by millions of hours of use, it virtually eliminates down time for clutch repair.



AUTOMATIC BLADE CONTROL (optional) cuts grading time in half. Operator sets desired slope on dial and only has to control depth of cut. Manufactured by Preco Incorporated, the unit automatically maintains blade slope within ⅛" in 10'. Available factory installed.



IN-SEAT STARTING (standard) offers operator finger-tip convenience and positive starts in any weather. Another feature: improved mechanical blade controls provide precise adjustment and ease of engagement. "Anti-creep" lock makes blade stay put under load.

UNION



The *Live Wire Rope Organization

Charged with creative energy

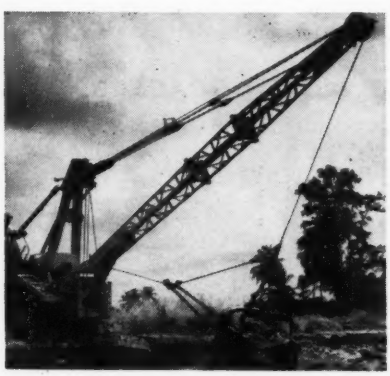
To be dubbed "live wire" by customers is nice. But it also is a warning signal which alerts our organization to stay alive to the fact that a greater output of creative energy is necessary when you're in front running position.

In the Union research laboratory and in those of the steel producing organization in which Union is integrated, technicians are hard at work on many new projects. They were started and will be finalized in the field where Union engineers spend more time than in the laboratory.

Classic example of what results from such deep and constant probing is the Tuffy family of wire ropes and slings, each one of them engineered to a specific job. Among 1600 standard wire rope constructions, in day to day production, none could be classified as the ultimate low cost wire rope for bulldozers, draglines, scrapers or hoisting equipment. One by one new metallurgical specifications and rope and sling constructions were tailored to meet the different but tough operating conditions inherent in the jobs these machines perform.

Tens of thousands of applications have established the unchallenged supremacy of Tuffy special purpose wire ropes and slings.

Tuffy Wire Ropes and Slings are "Job Prescribed" for Tough Jobs



Tuffy Balanced Dragline Rope





Tuffy Balanced Scraper Rope



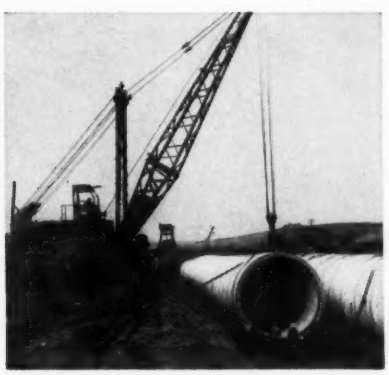


Tuffy Balanced Dozer Rope





At Mount Rushmore National Memorial in South Dakota small fissures in the sculptured faces of Washington, Jefferson, Lincoln and Roosevelt are being sealed with granite dust and white lead. Though the granite sculpture is estimated to last for thousands of years, this preventive maintenance will keep the surfaces smooth and slow the natural erosion process. The insert shows how workmen are suspended on Union Wire Rope.



For "Live Wire" Service— Look Up Your Union Distributor in the Yellow Pages

When you get him on the wire, you're sure to get the best in wire rope and slings—plus service that helps you get from Union Wire Rope products all the quality and long life Union builds into them. Union Wire Rope Corporation, 2144 Manchester Avenue, Kansas City 26, Missouri.

Tuffy® Wire Rope Tips



Guard Against These Killers!...Get the Full Measure of Service-Life Built In By Wire Rope Specialists.

Rusty Road to Ruin



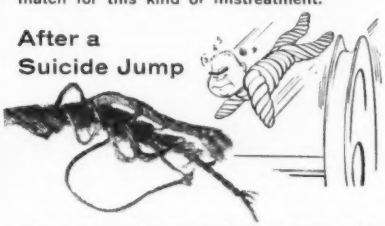
Rust—No. 1 enemy of steel—takes a heavy toll in wire rope life. The one-strand break shown here resulted when the rope was allowed to become rust-bound through lack of lubrication. Tests show that properly lubricated rope has up to 10 times the life expectancy of dry rope.

Crushed by a Tractor Cleat



The Sunday punch for this piece of wire rope was delivered by a tractor cleat—just one of many crushing injuries caused by rope being run over or banged into by hard, sharp objects. Even the toughest wire rope is no match for this kind of mistreatment.

After a Suicide Jump



This rope jumped out of sheave and was soon destroyed by pulling around the shaft. Actually it was a case of sudden slack which threw the rope out of the sheave.

Burned on a Frozen Sheave



End of the line came quickly for this rope as the result of operating over a sheave that did not turn. Note the exceptionally heavy abrasion on one side of the rope. Sheaves should be checked thoroughly and often.

Would you like a copy of a booklet in which more than a score of Tuffy Tips like those above are reproduced. If so, write Union Wire Rope Corporation, 2144 Manchester Ave., Kansas City 26, Missouri.

Tuffy Balanced Slings and Hoist Lines



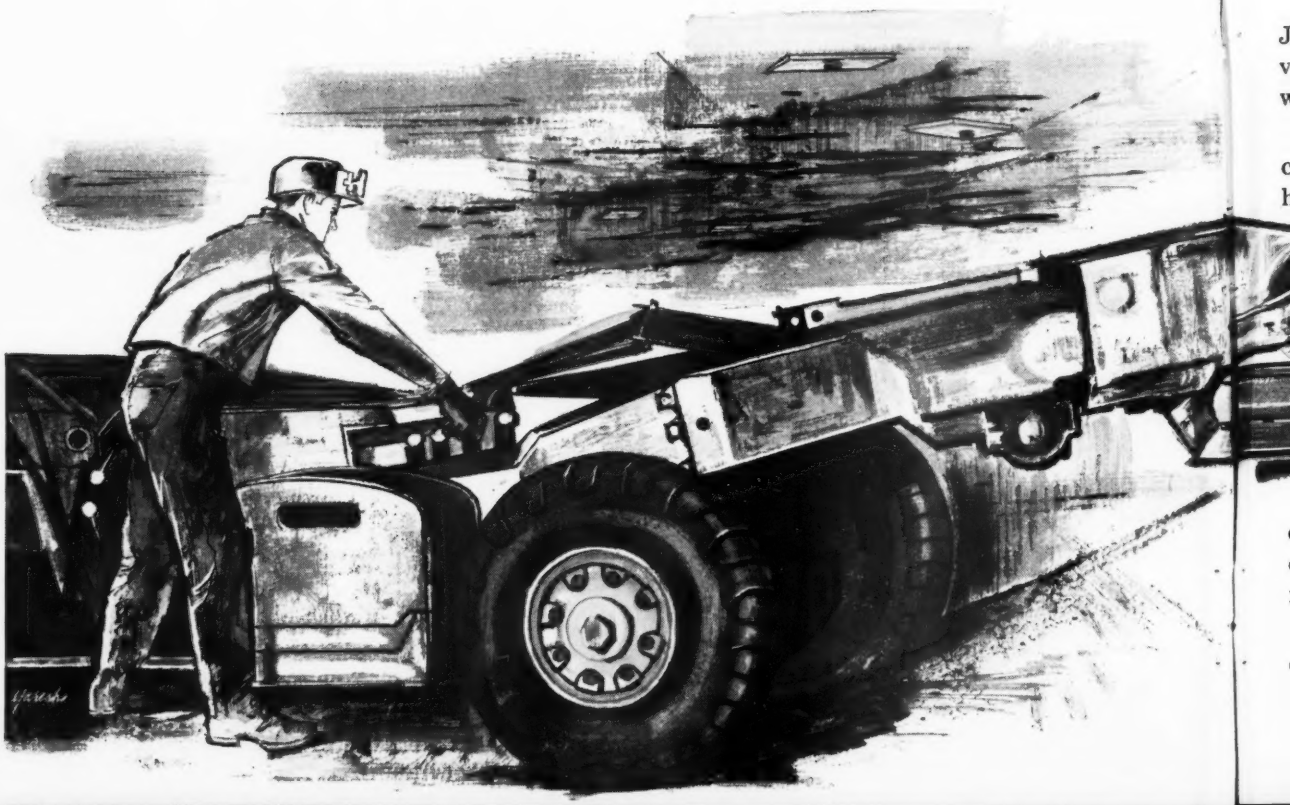
2-C

UNION Wire Rope

Subsidiary of ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Southwest Steel Products

JEFFREY UNIVERSAL COAL CUTTERS . .



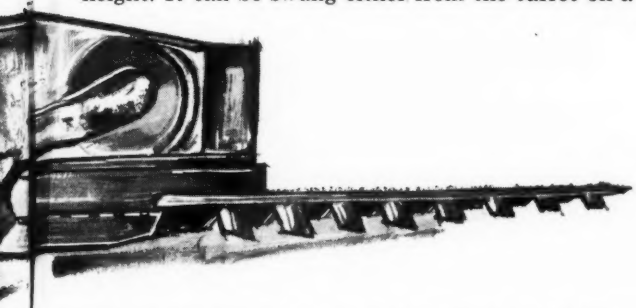


Two identical compartments, carrying duplicate controls, enable the operator to direct all operations from either side of the machine. No need to shift from side to side, and the operator has excellent protection.

cut any place in the seam from 14" below floor level to 13' above

Jeffrey Universal Coal Cutters (AC or DC) are designed to meet various mine conditions and are available for working in mines with seam heights ranging from three feet to thirteen feet.

Jeffrey cutting machines mounted on rubber tires have a cutting head which can rotate and is instantly adjustable in height. It can be swung either from the turret on a long radius



or from the cutter head on a shorter radius. This permits bottom or top cutting any place in the seam or for making a shear cut right or left of center.

These machines feature the latest developments in coal cutting efficiency to give more workability without breakdowns... important advantages in getting higher production.

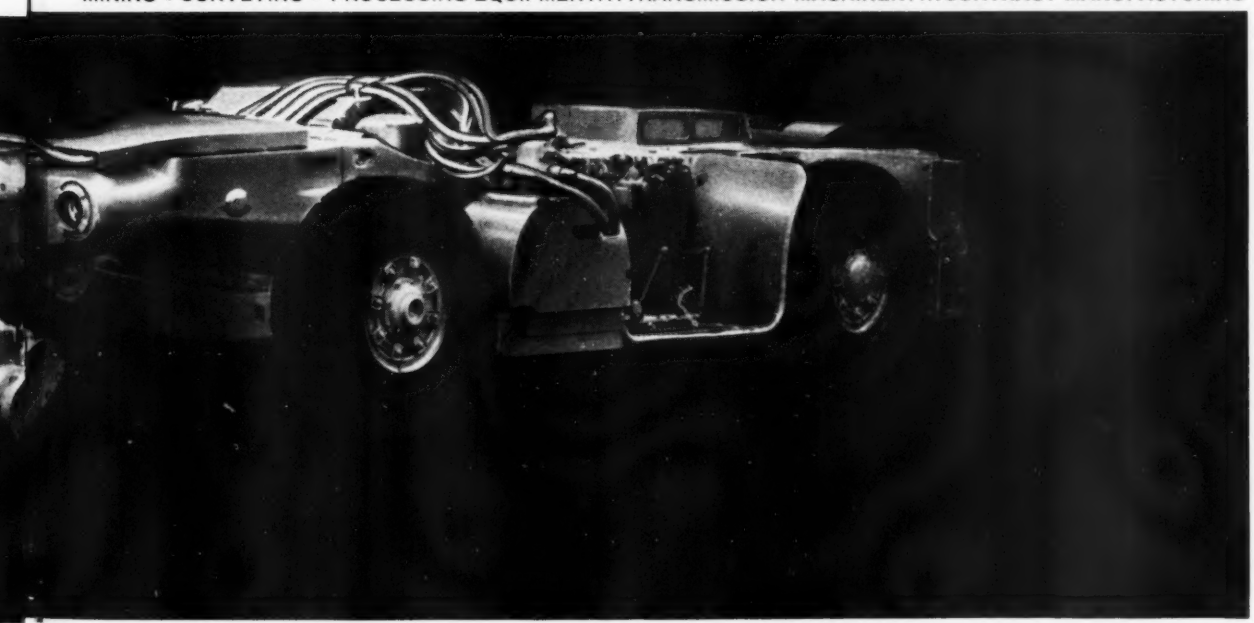
ADVANTAGES

1. Full hydraulic control of all operations except cutter chain drive
2. Easy to operate and control—giving quick response from fingertip controls
3. Built for safety and speed
4. Designed for hard cutting
5. Constructed to stand up under rugged going
6. Have maximum flexibility and low cost operation—no operating time wasted
7. More smooth cuts per shift
8. Operating and control mechanisms are accessible for maintenance

JEFFREY

THE JEFFREY MANUFACTURING COMPANY
958 North Fourth Street
Columbus 16, Ohio

MINING • CONVEYING • PROCESSING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING





There isn't much fanfare about BOWDIL announcements . . .

Any new development is so thoroughly mine-tested for such a long time that practically everybody knows what we're up to.

When certain the product is right, we talk about it. This is not just modesty . . . it's our policy.

Here are 3 new developments to help you cut costs, meet modern demands more economically, improve production and most important . . . your profits.

1 *New* "THIN-KERF" CUTTER CHAIN



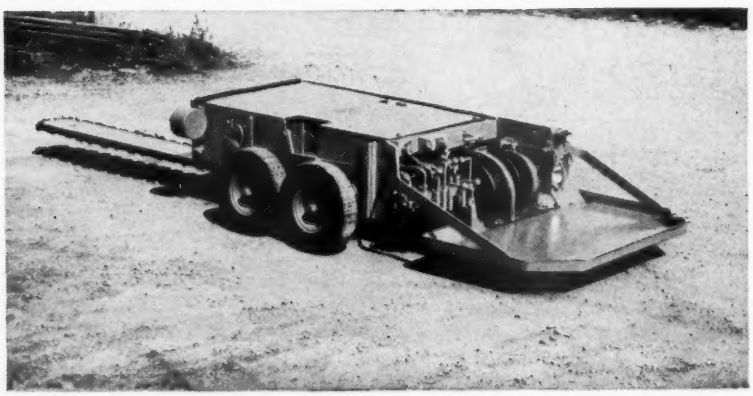
SMALL
VERSATILE

Proving very popular in money-making operations of Virginia and W. Virginia coal fields. It lends itself best to use on machines delivering up to 15 h.p. and kerf of 3″ to 3½″. Reduces amount of cutting to the point where higher feed speeds are realized . . .

and CLEANER CUTS!

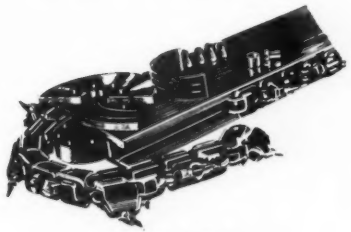
Example:

The much-in-demand new "compact" mining machines are featuring the new "Thin-Kerf" Chain and Bar, with Bowdil Bits & Sprockets.

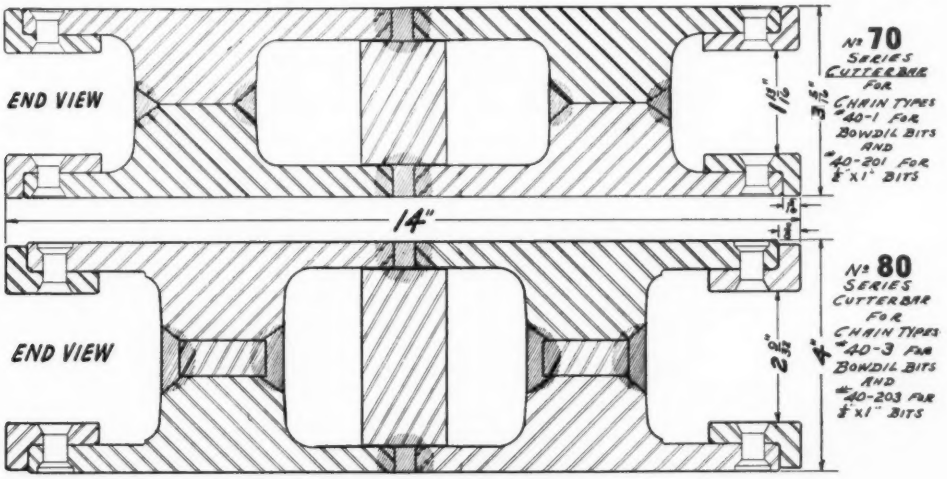


2 *New* SUPER-STRONG CUTTERBAR

Now being built to fit all of the newest heavy-duty machines. The Series #80 has been beefed up proportionately greater overall to meet the demands of such machines, (including heavier wearing strips and rivets), is designed for use of the stronger new Bowdil Chain and Sprockets. Compare dimensions of the new #80 with standard Bowdil Bar #70.

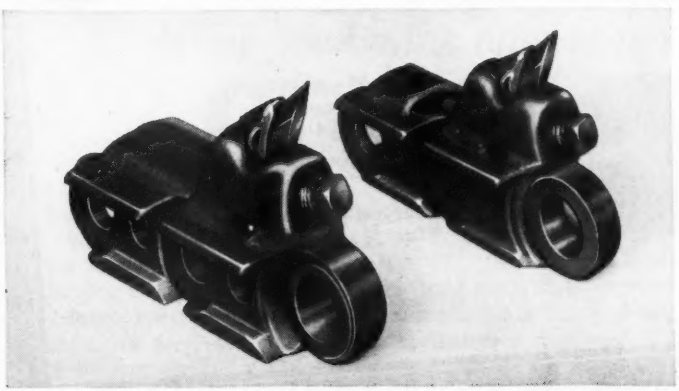


SERIES
No. 80



3 *New* Heavy-Duty BOWDIL CHAIN #40-3

ALSO USED ON CONTINUOUS MINING MACHINES





Both views show #40-3 at left, standard Bowdil Chain (#40-1) at right. Photos used for comparison illustrate the rugged strength of the new #40-3.

The **BOWDIL**
COMPANY
CANTON 1, OHIO

All items are in full production with prompt delivery.
Your inquiry is invited . . . we'd like to hear from you. Phone GLendale 6-7176

...record low-cost performance set by TORKAR on the job!

Parts cost of only 1/2 cent per ton!

JOANNE COAL COMPANY
UNION TRUST BUILDING
PITTSBURGH 19, PA.

March 15th, 1960

Mr. Gordon MacVean,
National Mine Service Company,
2530 Koppers Building,
Pittsburgh 19, Pennsylvania.

Dear Mr. MacVean:

It is a pleasure to state our experience with the two National Mine TorKars which have been in our service since April 7, 1958.

We have kept detailed records of the performance of various makes of shuttle cars in our mines, as to be expected, and the TorKars show up extremely well.

You will be gratified to know that the two TorKars have hauled 343,882 tons of clean coal at a maintenance parts cost of only 0.5¢ per ton, with less than 90 hours of downtime for repairs. Cable costs were 65 percent of total maintenance parts cost of $1,679.52.

I will add only that when additional shuttle cars were ordered this year, TorKars were chosen.

Very truly yours,

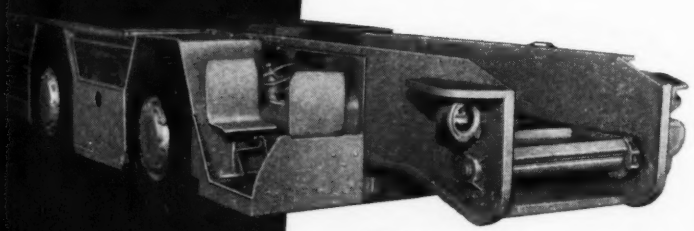
JOANNE COAL COMPANY

Charles B Baton

Charles B. Baton,
Vice President

CBB:bh

The Trend is to TorKar



The phenomenally low maintenance of the single-motor TORKAR can benefit *your* operations equally as well. Let us detail the interesting reasons, at your convenience!

National Mine Service Company

Koppers Building Pittsburgh 19, Pa.

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IN CANADA: NATIONAL MINE SERVICE (CANADA) LIMITED, Elliot Lake, Ontario



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CF&I Rock Bolts

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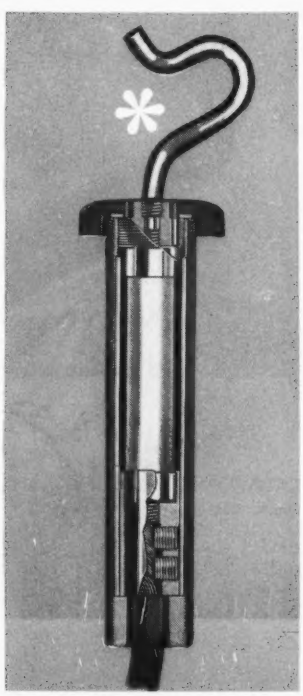
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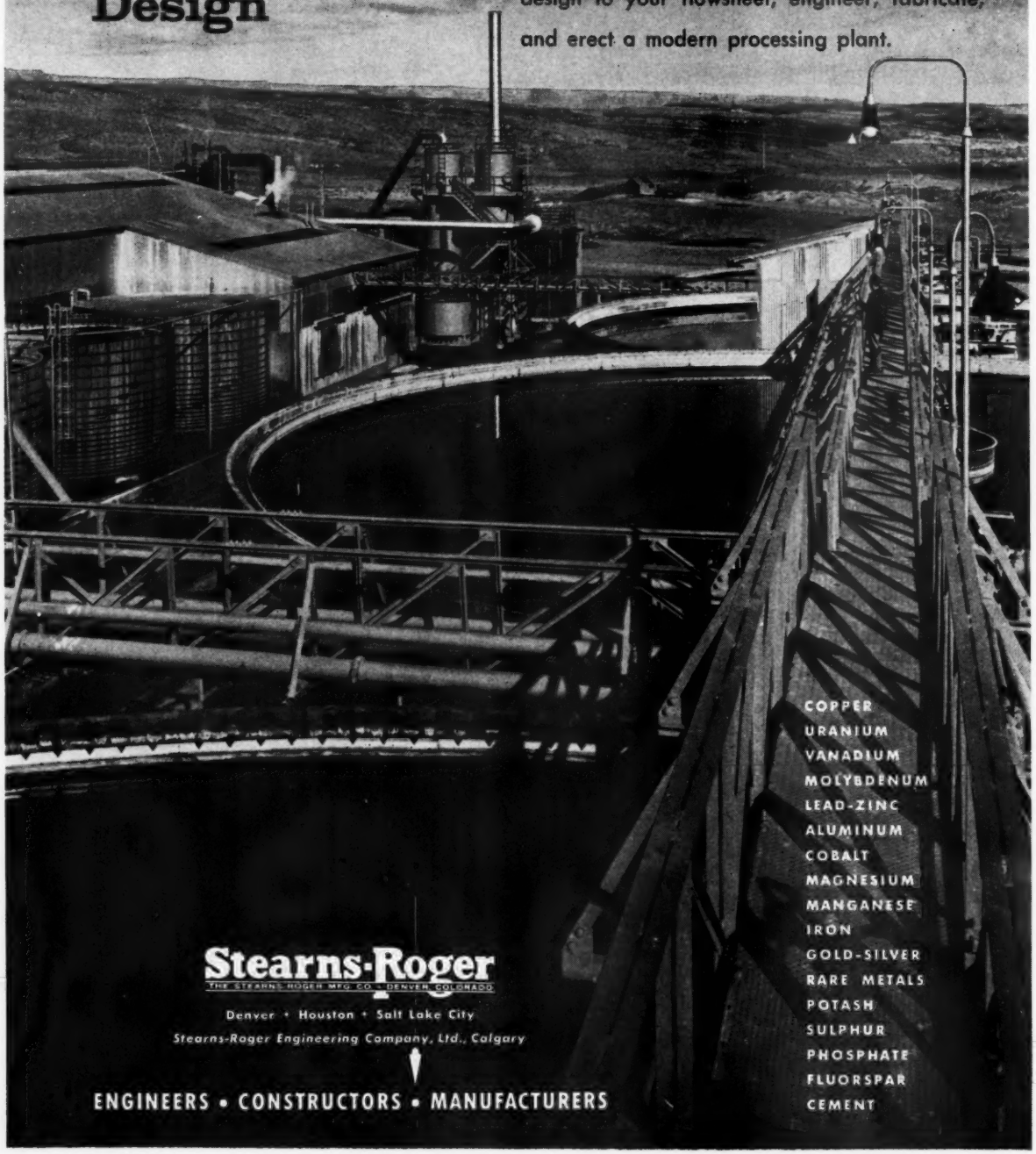
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Editorials

MINING CONGRESS JOURNAL
ROBERT W. VAN EVERA, Editor
May 1960

Iron Ore Projections

In a recent talk before the New York Society of Security Analysts, H. S. Harrison, Executive Vice President, Cleveland Cliffs Iron Co. projected the economic situation of the iron ore industry 20 years into the future. He logically covered three major problems that confront the industry today: 1) foreign competition; 2) the changing character of the industry, and 3) the present oversupply of iron ore.

His projections show that if the steel industry operated at capacity the demand for iron ore would grow from 150 million tons in 1960 to 190 million tons in 1980—with the additional 40 million tons becoming available from foreign sources. Such sources accounted for only five to seven million tons per year in the late forties, increasing to 36 million tons in 1959. Present aggressive development of deposits capable of producing high grade ore or concentrates in Canada, Latin America and other parts of the world seems to assure the additional supplies which Harrison forecasts.

As to domestic ores, he predicts that increased production of high grade agglomerates from taconites and jaspers will in part supplant the "standard grade" ores from the Lake Superior district. His projections show an increase in taconite capacity from 20 million tons in 1960 to 50 million in 1980, and a decrease in standard grades from 64 million to 30 million tons over the same period.

This 30 million tons compares with 97 million in the record year of 1951—a reduction of more than two-thirds. Furthermore, it must be assumed that these "standard grade" ores will be, for the most part, premium products—upgraded by beneficiation to meet the demand for a higher quality furnace feed. It is well known that major producers are giving concentrated attention to improving ore dressing techniques with a view to extending the economic life of conventional Lake Superior properties.

Harrison summed up the changing nature of the iron ore industry, as follows:

"Although the standard ores . . . are gradually running out, an even more important factor is the demand by the steel companies for a higher grade product than standard ore. The economics are such that high grade ores are becoming more and more a necessity. . . . The reasons for this are primarily two: first, the large increase in capital costs of a blast furnace which have climbed from $7½ million to anywhere from $25 million to $40 million . . .; and the second is the labor costs which have gone from 65¢ an hour to $3.39 per hour.

"When ore of 62 percent iron replaces ore with 52 percent, the production of a blast furnace will be increased by 20 percent from the increased iron analysis alone, so that if a company has five furnaces they, in effect, have built a sixth if they use high grade iron ore, and labor costs would be correspondingly reduced. . . . It is just as simple as that."

Producers agree that we now have an oversupply of iron ore, but such a condition is not uncommon in the industry. One needn't look very far into the past to see that the swings between abundance and scarcity have been frequent. But the long range outlook indicates that major new sources will be required. So despite a temporary oversupply today, the search for more iron ore will continue both at home and abroad in order to maintain a continuing supply of the principal raw material needed for making steel.

Some Facts on Federal Spending

Generally speaking, the House has approved appropriations for the agencies of the Department of Interior at substantially the level requested by the President. The economy scalpel did, however, cut deeply into some programs. The Office of Minerals Exploration, which loans Federal funds for the exploration and development of new domestic mines, requested $1.1 million for its next year's operation, the same as was granted for the present year. The House, noting that there is little current activity in this agency, cut the request in half.

This action is of interest when compared with our Government's expenditures for mineral development and exploration overseas. These figures were read into the Congressional Record by Senator Robert C. Byrd of West Virginia.

During the fiscal year ended June 30, 1959, according to Senator Byrd, the United States spent $8,268,000 developing mines and minerals under the foreign aid program. The expenditure for this purpose for the preceding fiscal year totaled $4,909,000.

A breakdown of these expenditures, country by country and project by project, also affords some interesting comparisons. During the two year period, our Government spent $1,655,000 on coal mine developments in China (Taiwan) and an additional $574,000 for this purpose in Yugoslavia. Meanwhile, the domestic coal industry still awaits the passage of a $2 million coal research and development bill, the need for which is widely recognized.

Modernization of A GYPSUM OPERATION

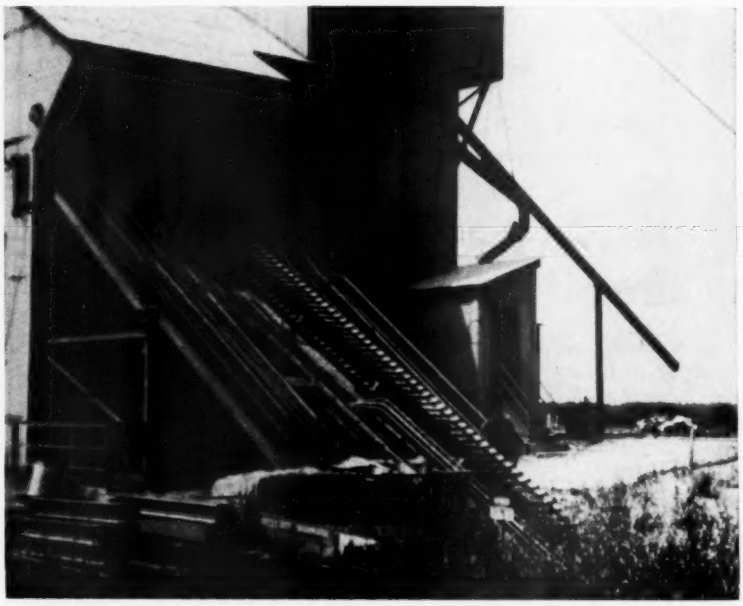
By ROBERT B. JORDAN
Chief Engineer
Universal Atlas Cement Division
U. S. Steel Corp.

ALTHOUGH it is recognized that the technique of mechanization and modernization of mining facilities is not new to mining men, Universal Atlas Cement is proud of its recent program at its gypsum mine at Clarence Center, N. Y. Proud of what this modernization has accomplished and of its one principal unique piece of equipment—the Stubbe Faltenband, which is a folded or accordian pleated belt conveyor, particularly adaptable to conveying crushed material not only at unusually steep gradients but around corners. This folded belt conveyor is only one link of the total modernization of this mine and is used simply to elevate and convey mined gypsum to the surface. The remainder of the program consisted of replacing manual operation below surface with modern machines.



The mined product, gypsum or hydrous calcium sulfate, is the principal source of sulphur trioxide as specified for Portland cements. Approximately four percent to five percent of gypsum is added to cement clinker, generally at the time of finish grinding, to retard the setting time and control hydration of the cement in concrete.

Universal Atlas produces gypsum principally for its own use in the manufacture of cement.



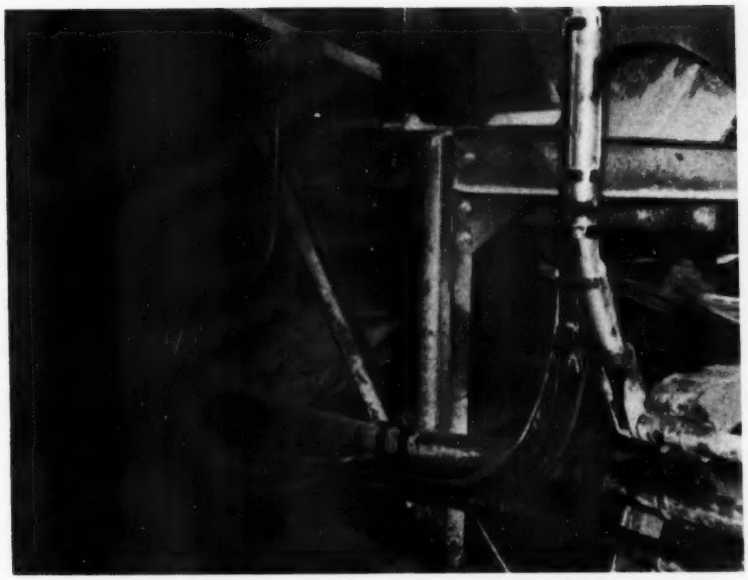
Folded belt conveyor enters original crushing and loading station. It is believed that the Clarence Center installation is the only one presently in the United States

Mining Methods Were of 1926 Era

The mine at Clarence Center has been in operation since 1926, and until recent improvements were completed, the mining methods employed were generally of that era. The gypsum seam, located from 50 to 75 ft below surface, varies from 24 to 42 in. in thickness.

To provide a picture of the changes that were accomplished in this modernization program, the operations that existed in this mine prior to modernization will be described.

Main access to the mine is via a 15 ft by 7½ ft shaft sloped 30° to the horizontal and extending 70 ft below the surface. At the foot of the slope is a main heading 20 ft wide and 7½ ft high extending 400 ft into the mine. From this point several headings were operated into the gypsum seam. The gypsum was mined by drilling and blasting, and then manually loaded on standard mine cars to be moved, in trains, to the main heading by one battery operated locomo-



Tensioning station at feed point for folded belt conveyor. The Clarence Center belt is designed for handling 150 tph of 95 lb per cu ft gypsum at about 200 fpm

Cut production costs or shut down the operation.

Faced with this decision, Universal Atlas chose to extensively mechanize the facilities of its Clarence Center, N.Y., mine

tive and one 250 v d-c trolley locomotive. Seventy-five 32 cu ft cars on a 36 in. gauge rail system were used in this service.

In the main heading at the foot of the slope, cars were transferred singly to the two track hoist way. From here they were hoisted by cable up the slope and bottom dumped into the on surface crushing station much as a skip hoist operates. The as-mined product was then crushed in two stages in single roll crushers to a minus 1½ in. with sizing control accomplished by a vibrating screen in closed circuit with the secondary crusher. Minus 1½ in. product was then conveyed by belt conveyor and bucket elevator and loaded in gondola cars for shipment.

Some Headings Only 36 In. High

In the mine, many of the headings were only 36 in. high and questionable roof areas were supported by timbering, providing an extremely cramped working area. Although this mine is regarded as relatively dry, there is an influx of approximately 850 gpm of water entering through the walls and roof of the slope about 35 ft below the surface. This and other mine water was directed by trenches to a reservoir near the foot of the slope from which point it was pumped to the surface. A pump attendant was required around the clock to prevent flooding in this important area.

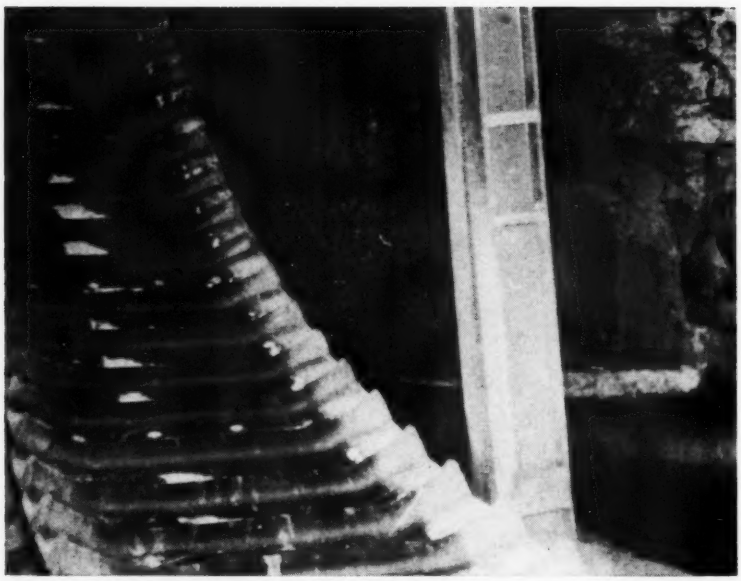
Several power systems were employed in these operations. On the surface the office and shop lighting was single phase, 110 v, 60 cycle and the surface machinery operated by 25 cycle, 440 v power. Underground power was provided by two motor generator sets, mounted on surface and powered by 25 cycle, 440 v motors producing 125 v d-c for mine lights and 250 v d-c for mine machinery.

Mounting costs of labor, shipping, and other services, to say nothing of the increase in taxes since World War II along with their more rapid rise in recent years, were reflected in the rising production costs for Clarence Center mine. In addition, the physical effort required for mucking under low roof and the general trend to seek easier jobs made it increasingly difficult to retain workers or to hire replacements for that type work. The economics of this situation necessitated a decision regarding continuance of this operation.

Rising Costs Forced Modernization

Two alternatives presented themselves: One, close the mine and dispose of the facility; or two, modernize the mine and reduce production costs. Studies and investigations led to the conclusion that it would be more advantageous to retain the facility and modernize the mine. Preliminary studies indicated that mechanical loading, moving the crushing operation into the mine, replacement of track haulage system with belt conveyors and conversion from 25 to 60 cycle power would produce the desired results.

These studies further showed that moving the crushing operations into the mine would have several advantages. It would permit using mine personnel at the crusher, narrower belt conveyors, and a bucket elevator for transport to surface. In addition, longer belt life could be anticipated due to the handling of the lighter and more uniformly distributed load

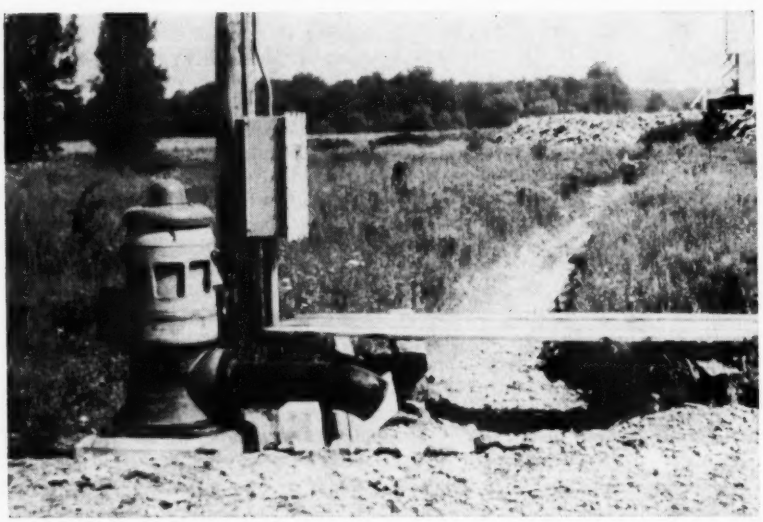


Belt at start of 40° incline. The belt is of molded rubber sections shaped somewhat like the pans on a pan conveyor with a single pleat fold between sections

of crushed gypsum.

Conversion to 60 cycle operation had the advantage of eliminating the necessity for generating and distributing d-c power. In addition, it minimized the hazards existing when power of various characteristics are present in the same area.

In the modernization, three new three hp post mounted drills were provided for drilling. One Goodman model 975 loading machine loads mined gypsum onto two Goodman type 870 shuttle cars which work in tandem and discharge onto a 36 in. Ropebelt conveyor. At present, this belt is 70 ft long, but it is designed to permit its eventual extension to 2000 ft as the mine face advances. The product is conveyed by the 36 in. belt to a Universal 36 in. Wobbler feeder which scalps off plus 1½ in. material and feeds it to a Hammermill for reduction to minus 1½ in. The Wobbler feeder and Hammermill both discharge minus 1½ in. product on a 24 in. Ropebelt system 1630 ft long which transports material to the main heading. From this point, it was originally contemplated to elevate the gypsum to the surface by means of a bucket elevator in a vertical shaft and then transport to the loading point by a belt conveyor on surface.



A 1500 gpm deep well pump is operated 5½ hr per day, during off-peak power demand periods, to dewater the underground sump. Controls provide for automatic or manual operation

An advertisement in a trade magazine for a folded belt conveyor of West German manufacture aroused our interest and an investigation of this product revealed that such a conveyor had great potential for this application. In the ultimate design, this folded belt conveyor was utilized thereby eliminating the shaft, vertical bucket elevator and surface belt conveyor. At the same time, capital investment was reduced substantially.

Features of Folded Belt Conveyor

The folded belt conveyor carries the trade name of Serpentix Conveyor and is manufactured by the Albert Stubbe Co. of Vlotho, West Germany. It is understood that the one installed at Clarence Center is the only one presently in the United States. The Serpentix Conveyor combines many of the features of a pan conveyor with those of a belt conveyor. The belt is of molded rubber sections shaped somewhat like the pans on a pan conveyor with a single pleat fold between sections. Beneath the rubber belt are steel trough-shaped stiffeners, which attach to a centrally located chain, thus providing belt strength and pulling power for the carrying strand. Support and guiding of the belt is provided by roller carriages located on about three ft centers which ride in U-shaped rail guides on either side of the conveyor. This conveyor can easily convey up a 40° slope and make several turns in a horizontal plane. A special section has been built which reportedly operates at 72°. Its pan-like feature reduces roll back of material on steep slopes and it is believed that this equipment has many applications in the handling of mined or quarried type material. At Clarence Center, the folded belt conveyor is approximately 250 ft long and is inclined approximately 30° to the horizontal. The belt sections are 31½ in. wide designed for 150 tph of 95 lb per cu ft gypsum at approximately 200 fpm.

Gypsum is discharged from the folded belt to the original crushing and loading station from which the primary crusher has been removed. Only the screen and secondary crusher are available but they are now being bypassed.

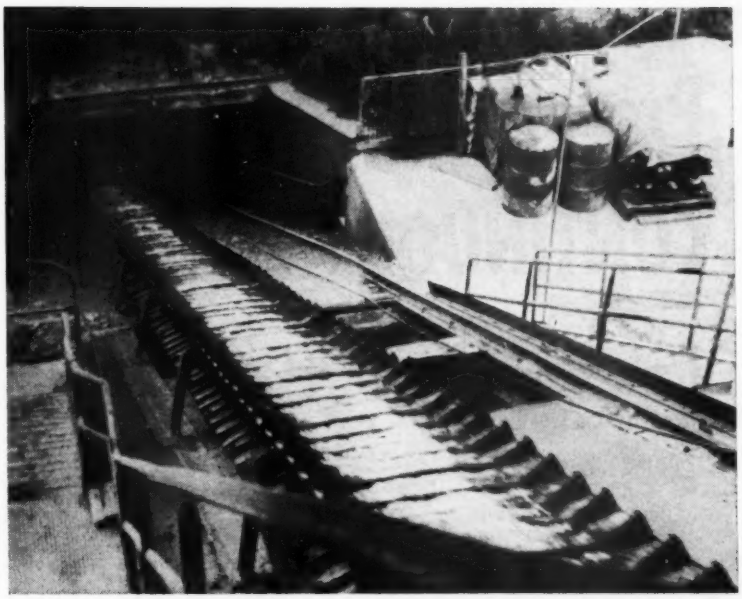
Conversion to 60-Cycle Power

All electrical equipment in the surface loading station was converted for 60 cycle power usage. Electric power for the mine is 4800 v, 60 cycle by

pole line to a bore-hole entrance near the crusher located in the mine. At this point, a 300 kva portable substation reduces voltage to 440 v for distribution. The drilling, loading and shuttle equipment is connected to three Kersey portable distribution boxes, which can be located adjacent to the operating area to keep the equipment trailing cables at minimum length.

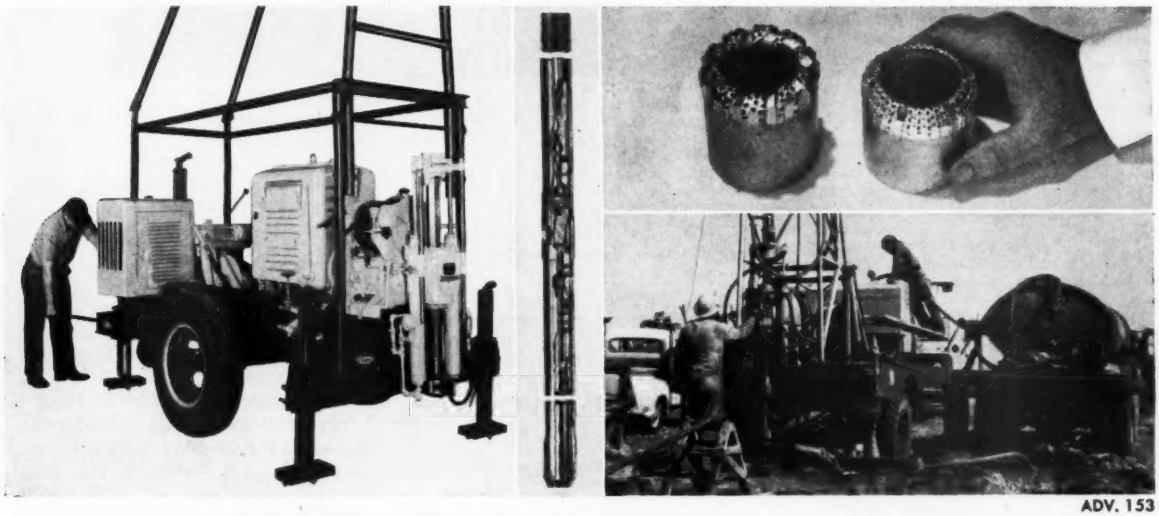
Roof support is now accomplished by roof bolting, and a new Fletcher DAE-13 roof control drill was provided for this purpose.

The water and pump attendant problem was resolved by rerouting trenching to a worked out section in the southerly part of the mine which was much lower than the main heading. A new 1500 gpm Fairbanks Morse deep-well pump with a 100 ft lift was mounted on surface above a sump in the low point of the worked out section. Pump controls provide for automatic or manual operation. At present, the timer is set to operate only on off-peak power demand periods and adequately dewaters the sump in 5½ hr per day. The worked out section of the mine has a capacity of several million gallons so that emergency repairs could be made to the pump without danger of flooding.



The pan-like feature of the conveyor sections reduces roll back of material on steep slopes

In the first few months of operation production costs have been reduced substantially. It is hoped that even greater savings can be realized when operating personnel gain experience and improve their techniques.



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Productivity of CONTINUOUS AND CONVENTIONAL Mining Equipment

Coal production from continuous mining machines has grown from 8,000,000 tons in 1952 to 70,000,000 tons in 1959—an increase from three percent of total underground production to 29 percent

By R. L. ANDERSON
Supervisory Commodity—
Industry Analyst—Coal
U. S. Bureau of Mines

CONTINUOUS mining in underground bituminous coal mines, as known today, began in the United States in 1948. Production from continuous mining was first measured separately in 1952, when it totaled 8,000,000 tons of bituminous coal. In 1959 an estimated 70,000,000 tons was produced by this method. There were 679 continuous mining machines in use in bituminous coal mines in 1958. In 1959, six manufacturers shipped 140 more.



Continuous Mining Operations Average 13 TPD per Man

Production by continuous mining increased from three percent of the total underground production that was mechanically loaded in 1952 to an estimated 29 percent in 1959. (See figure 1.) The major decreases in conventional mining during this period are shown under the headings, "Mobile loading into mine cars" and "Scrapers and conveyors." Hand loading was omitted from figure 1 because the percentage of underground output loaded by hand has changed little in the past five years, decreasing from 16 percent in 1954 to an estimated 14 percent in 1959.

The bituminous coal industry now has had 12 years' experience in continuous mining. In 1958, the latest year for which data are available on productivity by method of mining, continuous mining was practiced in 13 states. Forty-five mines operated 100-percent continuous mining in 1958 and averaged 13 tpd per man (for all men employed, both surface and underground) which was 11 percent higher than any other group included in this study. (See figure 2.) Productivity data as presented in this article were published, for the year 1956, in *Mining Congress Journal*, Volume 44, May 1958, pp. 54–60.

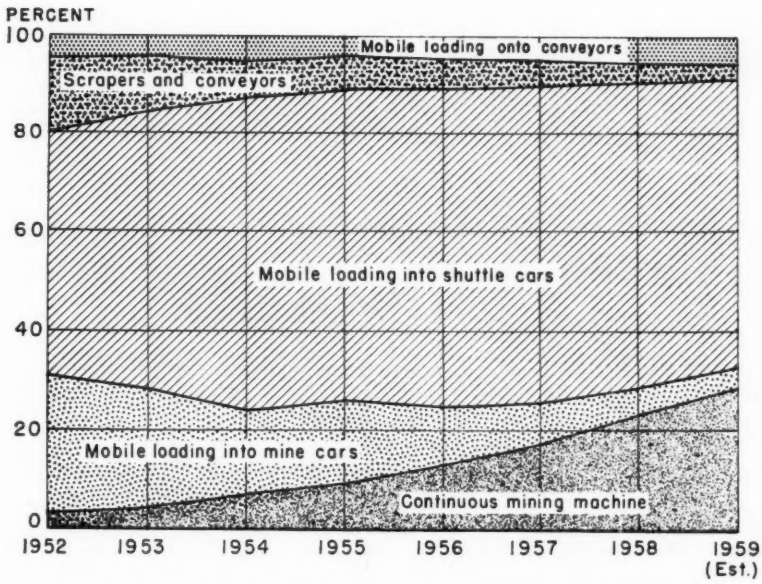


Fig. 1. Percentage of total mechanically loaded output at underground bituminous coal and lignite mines in the United States by method of mining and loading, 1952-59

Hand Loading Accounts for 14 Percent of Underground Output

Annual reports submitted by bituminous coal and lignite producers list net tons of coal loaded by various methods and the number of continuous mining machines and loading machines by type. These data are assembled by type of equipment to show mechanical loading, by states, and are published regularly by the Bureau of Mines in the familiar mechanical loading tables of the *Mineral Market Summary* for bituminous coal and lignite and of the *Minerals Yearbook*.

Data on production by method of mining and loading were assembled from production and mine operation reports, Form 6-1401-A, submitted by producers to the Bureau's Branch of Bituminous Coal Economics and Statistics, Division of Bituminous Coal. They were related to corresponding data on employment reported to the Bureau's Accident Analysis Branch on Form 6-1420-A. Because employment data reported by the operators are for total employment in each mine, not employment by method of loading, it is necessary to classify in a single group, all mines with only one predominant method of loading. For instance, all mines with over 90 percent of their coal loaded by mobile loaders into mine cars are placed in a single group to calculate productivity. However, tonnage hand loaded at mines with loading devices averaged less than one percent of their total production. Mines with mechanical loading that have less than 90 percent of their output loaded mechanically are included under "Mixed types of loading."

Total production of underground bituminous coal and lignite mines was 287,000,000 tons in 1958. Mines with mechanical loading produced 246,000,000 tons, and mines with 100-percent hand loading produced 41,000,000 tons. Table 35, page 64, of Bureau of Mines *Mineral Market Summary No. 2974* lists total production, by states, at mines using mechanical loading devices. These totals are comparable to the production figures used in this article.

Productivity calculations were based on total manshifts worked and the average number of men working daily, both underground and surface, including those working at the tipple, preparation plant, and mine shops and yards, but excluding office workers. Thickness of coal mined was reported by the producers. Thickness of coal seam was not compiled for mines using hand loading only, as many of the small mines did not report thickness.

All tonnage figures represent net tons of marketable coal and exclude washery and other refuse. "Tons" refers to net short tons of 2000 lbs. This report includes all underground mines producing 1000 tons a year or more but does not attempt to cover many small mines producing less than 1000 tons a year.

Productivity at Underground Mines Increases

Fifty-four percent of the total underground production of bituminous coal and lignite in the United States in 1958 was produced at mines

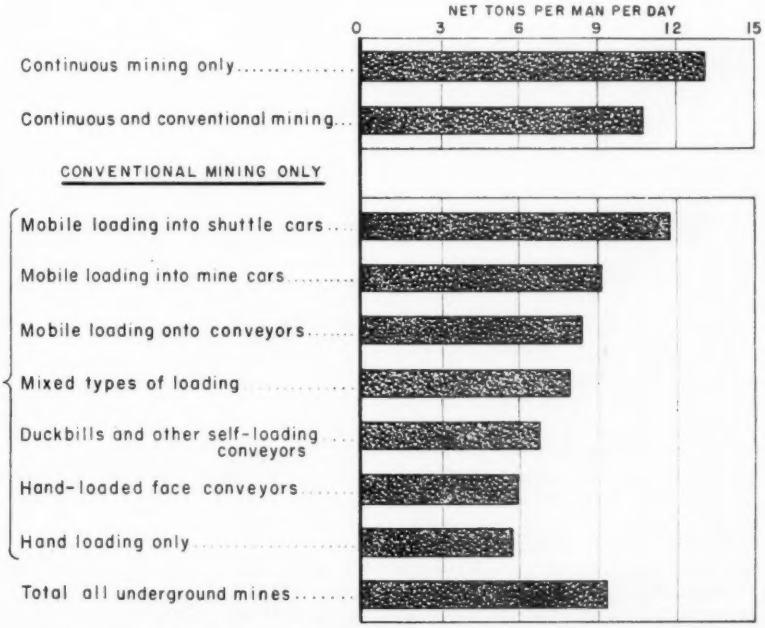


Fig. 2. Output per man per day at underground bituminous coal and lignite mines in the United States by method of mining and loading, in 1958

Table I. Productivity at underground bituminous coal and lignite mines in the United States, by method of mining and loading in 1956 and 1958

Method	Average tons per man per day[1]		Number of mines		Production				Average thickness of coal mined (inches)	
					Thousand net tons		Percentage of total			
	1956	1958	1956	1958	1956	1958	1956	1958	1956	1958
Continuous mining only	14.08	13.06	24	45	8,667	12,151	2.4	4.2	80	76
Both continuous and conventional mining	9.46	10.75	132	167	105,385	109,577	28.8	38.2	64	69
Conventional mining only:										
Mobile loading into mine cars	8.82	9.14	131	95	14,853	7,347	4.1	2.6	61	57
Mobile loading onto conveyors	7.47	8.38	48	45	6,205	7,051	1.7	2.4	39	42
Mobile loading into shuttle cars	11.17	11.76	380	373	120,150	80,905	32.8	28.2	61	65
Duckbills and other self-loading conveyors	6.50	6.79	45	41	2,371	1,036	0.6	0.4	42	46
Hand-loaded face conveyors	5.89	5.96	228	222	7,404	4,587	2.0	1.6	39	40
Mixed types of loading[2]	7.35	8.01	254	178	50,664	23,179	13.9	8.1	52	53
Hand loading only	5.65	5.77	5,300	5,153	50,075	41,051	13.7	14.3	(3)	(3)
Total	8.62	9.38	6,542	6,319	365,774	286,884	100.0	100.0	(3)	(3)

1 *Calculated on basis of average number of men working daily. This includes all men engaged in the production and preparation of coal.*
2 *Includes a few mines with a small tonnage mined by continuous mining.*
3 *Not available*

with a single type of mining or loading: Conventional mining with only one type of loading accounted for 50 percent, and mines that operated "Continuous mining only" produced four percent. The remaining 46 percent of the total underground production was produced by "Both continuous and conventional mining" (38 percent) and conventional mining with "Mixed types of loading" (eight percent).

Underground mines have been separated into nine groups. (See table 1). The first seven groups include mines with 90 percent or more of total production loaded mechanically. The eighth group, "Mixed types of loading," includes conventional mining with mixed types of loading and also other methods of mining and mechanical loading with less than 90 percent of total output mechanically loaded. As scraper loading was too small to be listed separately, it was included with "Mixed types of loading." The ninth group, "Hand loading only," includes more than 5000 mines employing no mechanical loading devices; however, they produced only 14 percent of the total underground output.

Generally, productivity at underground mines increased in 1958 over 1956. Average productivity at all underground mines increased from 8.62 tpd per man in 1956 to 9.38 in 1958. Data for 1956 are also included in table 1 for comparison. There was an increase in 1958 average productivity, over 1956, in each group, by method of mining and loading, except "Continuous mining only." The number of mines with 100-percent continuous mining increased from 24 in 1956 to 45 in 1958. Evidently, these 21 additional mines that were converted to 100-percent continuous mining in this two-year period were not able to develop fully the continuous mining areas and therefore did not operate at maximum efficiency during 1958.

Figure 2 shows productivity by method of mining and loading for all underground bituminous coal and lig-

Table II. Productivity at underground bituminous coal mines in Kentucky, by method of mining and loading in 1958

Method	Average tons per man per day[1]	Number of mines	Production		Average thickness of coal mined (inches)
			Thousand net tons	Percentage of total	
Continuous mining only	13.82	7	1,105	2.3	48
Both continuous and conventional mining	11.15	10	8,788	19.0	58
Conventional mining only:					
Mobile loading into mine cars	8.46	15	1,228	2.7	49
Mobile loading onto conveyors	9.46	9	1,973	4.3	40
Mobile loading into shuttle cars	11.81	83	17,896	38.8	56
Hand-loaded face conveyors	5.10	12	161	0.4	34
Mixed types of loading	8.68	25	2,386	5.2	48
Hand loading only	7.23	1,612	12,585	27.3	(2)
Total	9.63	1,773	46,122	100.0	(2)

1 *Calculated on basis of average number of men working daily. This includes all men engaged in the production and preparation of coal.*
2 *Not available.*

Table III. Productivity at underground bituminous coal mines in Ohio, by method of mining and loading in 1958

Method	Average tons per man per day[1]	Number of mines	Production		Average thickness of coal mined (inches)
			Thousand net tons	Percentage of total	
Continuous mining only	18.48	4	908	9.9	53
Both continuous and conventional mining	12.22	3	3,969	43.1	64
Conventional mining only:					
Mobile loading into mine cars	11.42	7	1,373	14.9	55
Mobile loading onto conveyors	(2)	(2)	(2)	(2)	(2)
Mobile loading into shuttle cars	11.24	10	1,803	19.6	54
Hand-loaded face conveyors	4.99	10	52	0.6	41
Mixed types of loading	5.76	10	149	1.6	39
Hand loading only	3.83	121	945	10.3	(3)
Total	9.81	165	9,199	100.0	(3)

1 *Calculated on basis of average number of men working daily. This includes all men engaged in the production and preparation of coal.*
2 *Included in "Mixed types of loading"; not published to avoid disclosing individual operations.*
3 *Not available.*

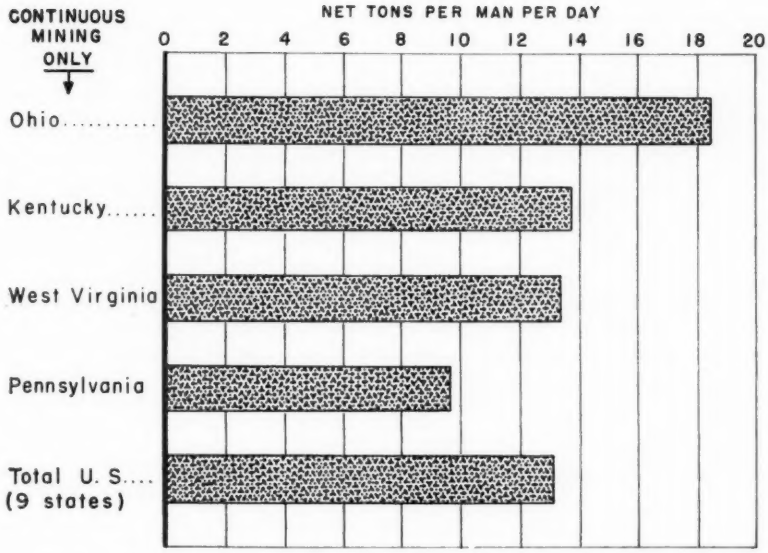


Fig. 3. Output per man per day at bituminous coal mines in United States, using continuous mining only, in 1958

Table IV. Productivity at underground bituminous coal mines in Pennsylvania, by method of mining and loading in 1958

Method	Average tons per man per day[1]	Number of mines	Production		Average thickness of coal mined (inches)
			Thousand net tons	Percentage of total	
Continuous mining only	9.56	13	2,957	6.2	65
Both continuous and conventional mining	8.99	56	33.814	70.7	68
Conventional mining only:					
Mobile loading into mine cars	7.61	11	780	1.6	55
Mobile loading onto conveyors	9.41	7	654	1.4	46
Mobile loading into shuttle cars	9.36	25	2,469	5.2	51
Duckbills and other self-loading conveyors	5.80	15	495	1.0	36
Hand-loaded face conveyors	5.85	91	1,138	2.4	37
Mixed types of loading	7.72	28	2,154	4.5	54
Hand loading only	3.77	563	3.329	7.0	(2)
Total	8.03	809	47,790	100.0	(2)

1 *Calculated on basis of average number of men working daily. This includes all men engaged in the production and preparation of coal.*
2 *Not available.*

Table V. Productivity at underground bituminous coal mines in West Virginia, by method of mining and loading in 1958

Method	Average tons per man per day[1]	Number of mines	Production		Average thickness of coal mined (inches)
			Thousand net tons	Percentage of total	
Continuous mining only	13.42	16	3,945	3.6	73
Both continuous and conventional mining	11.85	62	41,526	38.3	66
Conventional mining only:					
Mobile loading into mine cars	10.04	31	3.022	2.8	58
Mobile loading onto conveyors	8.42	20	3,125	2.9	37
Mobile loading into shuttle cars	12.14	134	33,624	31.1	61
Duckbills and other self-loading conveyors	(2)	(2)	(2)	(2)	(2)
Hand-loaded face conveyors	7.33	51	2,169	2.0	37
Mixed types of loading	7.84	54	11,756	10.9	42
Hand loading only	5.60	915	9.065	8.4	(3)
Total	10.13	1,283	108,232	100.0	(3)

1 *Calculated on basis of average number of men working daily. This includes all men engaged in the production and preparation of coal.*
2 *Included in "Mixed types of loading"; not published to avoid disclosing individual operations.*
3 *Not available.*

nite mines in the United States in 1958. The groups under "Conventional mining only" in figure 2 are arranged in descending order of productivity, which is different from the arrangements in the tables.

Four states—Kentucky, Ohio, Pennsylvania and West Virginia—had sufficient mines in "Continuous mining only" in 1958 to be listed separately. Figure 3 and tables 2, 3, 4, and 5 show comparative productivity for these four states.

45 Mines Employ Continuous Mining Only

Detailed data on productivity by states for the various methods of mining and mechanical loading, including groups 1 through 8, are listed in table 6.

The first group of table 6, "Continuous mining only," included 45 mines in nine states. These mines employed 137 continuous mining machines and 62 loading machines used in conjunction with continuous mining. They prodced 12,000,000 tons, or 21 percent, of the total 56,000,000 tons mined by continuous mining in 1958. Average productivity by states for this group of mines varied from 9.56 tpd per man in Pennsylvania to 18.48 in Ohio. This great difference was owing to many conditions besides the thickness of coal mined, because the state with the highest productivity had a comparatively low average thickness of coal mined.

The second group, "Both continuous and conventional mining," includes mines in which both continuous mining machines and other loading devices, not used in conjunction with the continous mining machines, were operated. In 1958 this group produced 44,000,000 tons by continuous mining and 66,000,000 tons by conventional mining. The conventional mining part of this tonnage was divided as follows: Mobile loading into mine cars, 4,000,000 tons; mobile loading onto conveyors, 2,000,000 tons; mobile loading into shuttle cars, 59,000,000 tons; and Duckbills or other self-loading conveyors and hand-loaded face conveyors, 1,000,000 tons.

This group included 167 mines in 12 states. These mines employed 540 continuous mining machines and 160 mobile loading machines used in conjunction with continous mining. In addition, the following numbers of loading devices were used: Mobile loading into mine cars, 73; mobile loading machines onto conveyors, 74; mobile loading machines into shuttle cars, 963; Duckbills or other self-

loading conveyors, 7; and hand-loaded face conveyors, 73.

Average productivity by states for this group, "Both continuous and conventional mining," varied from a low of 8.81 tpd per man at Utah mines to a high of 18.49 at Illinois mines. Forty-two percent of the total underground output of bituminous coal and lignite in 1958 was produced at mines using continuous mining machines in part or all of the mine.

The third group, "Conventional mining—mobile loading into mine cars," included mines in 15 states em-

Table VI. Productivity at underground bituminous coal and lignite mines in the United States, by method of mining and loading, by states, 1958

State	Average tons per man per day[1]	Number of mines	Production: Thousand net tons	Production: Percentage of total	Average thickness of coal mined (inches)
Continuous Mining Only					
Kentucky	13.82	7	1,105	9.1	48
Ohio	18.18	4	908	7.5	53
Pennsylvania	9.56	13	2,957	24.3	65
West Virginia	13.42	16	3,945	32.5	73
Other States	16.37	5	3,236	26.6	106
Total	13.06	45	12,151	100.0	76
Both Continuous and Conventional Mining					
Alabama	9.89	3	3,066	2.8	45
Colorado	12.33	6	580	0.5	106
Illinois	18.49	6	7,957	7.3	95
Kentucky	11.15	10	8,788	8.0	58
Ohio	12.22	3	3,969	3.6	64
Pennsylvania	8.99	56	33,814	30.9	68
Utah	8.81	6	2,430	2.2	132
Virginia	9.59	11	6,089	5.6	63
West Virginia	11.85	62	41,526	37.9	66
Other States	11.89	4	1,358	1.2	63
Total	10.75	167	109,577	100.0	69
Conventional Mining—Mobile Loading Into Mine Cars					
Illinois	6.64	9	264	3.6	74
Indiana	6.70	5	37	0.5	69
Kentucky	8.46	15	1,228	16.7	49
Ohio	11.42	7	1,373	18.7	55
Pennsylvania	7.61	11	780	10.6	55
Virginia	10.21	5	175	2.4	48
West Virginia	10.04	31	3,022	41.1	58
Other States	6.99	12	468	6.4	69
Total	9.14	95	7,347	100.0	57
Conventional Mining—Mobile Loading Onto Conveyors					
Alabama	5.61	3	709	10.0	56
Kentucky	9.46	9	1,973	28.0	40
Pennsylvania	9.41	7	654	9.3	46
West Virginia	8.42	20	3,125	44.3	37
Other States	9.03	6	590	8.4	58
Total	8.38	45	7,051	100.0	42
Conventional Mining—Mobile Loading Into Shuttle Cars					
Alabama	7.14	7	3,138	3.9	54
Colorado	10.06	12	409	0.5	142
Illinois	14.79	28	10,022	12.4	84
Indiana	12.37	13	3,311	4.1	74
Kentucky	11.81	83	17,896	22.1	56
Ohio	11.24	10	1,803	2.2	54
Pennsylvania	9.36	25	2,469	3.0	51
Tennessee	13.27	7	1,236	1.5	64
Utah	11.40	27	2,411	3.0	139
Virginia	10.81	20	4,129	5.1	59
West Virginia	12.14	134	33,624	41.6	61
Other States	7.59	7	457	0.6	76
Total	11.76	373	80,905	100.0	65
Conventional Mining—Duckbills or Other Self-Loading Conveyors					
Colorado	7.22	15	200	19.3	78
Illinois	6.64	3	46	4.4	49
Montana	7.46	3	13	1.3	56
Pennsylvania	5.80	15	495	47.8	36
Other States	9.15	5	282	27.2	41
Total	6.79	41	1,036	100.0	46
Conventional Mining—Hand-Loaded Face Conveyors					
Alabama	3.69	13	87	1.9	31
Arkansas	3.95	11	65	1.4	29
Colorado	5.77	15	249	5.4	88
Kentucky	5.10	12	161	3.5	34
Maryland	4.42	6	129	2.8	36
Ohio	4.99	10	52	1.2	41
Oklahoma	3.43	4	290	6.3	34
Pennsylvania	5.85	91	1,138	24.8	37
Tennessee	4.47	4	100	2.2	32
West Virginia	7.33	51	2,169	47.3	37
Other States	8.22	5	147	3.2	70
Total	5.96	222	4,587	100.0	40
Conventional Mining—Mixed Types of Loading[2]					
Alabama	6.75	4	977	4.2	52
Colorado	4.71	8	857	3.7	60
Illinois	16.14	4	1,848	8.0	83
Kentucky	8.68	25	2,386	10.3	48
Ohio	5.76	10	149	0.6	39
Pennsylvania	7.72	28	2,154	9.3	54
Tennessee	3.18	3	32	0.1	33
Virginia	8.41	31	2,491	10.8	55
West Virginia	7.84	54	11,756	50.7	42
Other States	8.02	11	529	2.3	208
Total	8.01	178	23,179	100.0	53
Total—All Mines With Mechanical Loading					
Alabama	7.52	32	8,147	3.3	50
Arkansas	3.96	12	78	—	29
Colorado	6.94	61	2,445	1.0	90
Illinois	16.11	51	23,170	9.4	90
Indiana	12.61	20	4,599	1.9	71
Iowa	10.98	3	100	—	63
Kentucky	11.00	161	33,536	13.6	54
Maryland	4.42	7	144	0.1	35
Montana (bit. & lig.)	6.88	9	176	0.1	76
Ohio	11.95	44	8,254	3.4	58
Oklahoma	3.64	5	349	0.1	35
Pennsylvania	8.77	246	44,461	18.1	64
Tennessee	10.11	18	1,957	0.8	54
Utah	10.19	40	5,315	2.2	133
Virginia	9.64	71	13,155	5.4	60
Washington	5.20	5	230	0.1	135
West Virginia	10.97	368	99,167	40.3	60
Wyoming	8.18	9	363	0.1	91
Other States	6.26	4	187	0.1	338
Total	10.48	1,166	245,833	100.0	65
Grand Total—All Underground Mines					
With mechanical loading	10.48	1,166	245,833	85.7	65
With hand loading only	5.77	5,153	41,051	14.3	(3)
Total, all underground mines	9.38	6,319	286,884	100.0	(3)

1 *Calculated on basis of average number of men working daily. This includes all men engaged in the production and preparation of coal.*

2 *Includes a few mines with a small tonnage mined by continuous mining.*

3 *Not available.*

ploying 220 loading units. Illinois registered the lowest tons per man per day (6.64) and Ohio the highest (11.42) for this group. The average for all states was slightly lower than the average for all methods of mining and loading at underground mines.

The fourth group, "Mobile loading onto conveyors," employed 183 loading units and ranged from 5.61 tpd per man in Alabama to 9.46 in Kentucky. Average productivity for this group was more than two tpd per man higher than for the group, "Hand-loaded face conveyors," and almost two tpd per man higher than for the group, "Duckbills or other self-loading conveyors."

Loader-Shuttle Car Group Produced 28 Percent of Underground Output

The fifth group, "Mobile loading into shuttle cars," produced 28 percent of the underground output in 1958 and averaged a higher productivity than any other except "Continuous mining only." This group included 373 mines in 15 states employing 1264 mobile loading machines. Average tons per man per day ranged from 7.14 in Alabama to 14.79 in Illinois. Average productivity in Illinois for "Mobile loading into shuttle cars" was higher than the average of the total for all mines in the group "Continuous mining only."

The sixth group, "Duckbills or other self-loading conveyors," included mines in seven states employing 150 loading devices. Productivity in this group averaged 6.79 tpd per man, approximately one ton higher than mines using hand-loaded face conveyors only.

The seventh group, "Hand-loaded face conveyors," included mines with the lowest productivity of any group employing mechanical loading. It included 222 mines in 13 states employing 799 conveyor units.

All Mines Average 11.33 TPD per Man

The eighth group, "Mixed types of loading," included 178 mines in 17 states. The group includes, in addition to mines with mixed types of loading, all mines using mechanical loading with less than 90 percent of output mechanically loaded. In 1958 more than 2,000,000 tons of coal was loaded by hand at mines that had not completely converted to mechanical loading.

The following equipment was used at mines in this eighth group: Continuous mining machines, 2; mobile loading machines into mine cars, 108; mobile loading machines onto conveyors, 131; mobile loading machines into shuttle cars, 196; Duckbills or other self-loading conveyors, 85; hand-loaded face conveyors, 358; and scraper loaders, 7.

Productivity by states varied from 3.18 tpd per man in Tennessee to 16.14 in Illinois. The average tons per man per day for all mines in the eighth group was 8.01, compared with 9.38 for all underground mines. This group of mines produced 23,000,000 net tons in 1958, divided as follows: Mobile loading into mine cars, 3,000,000; mobile loading onto conveyors, 4,000,000; mobile loading into shuttle cars, 11,000,000; hand-loaded face conveyors, 3,000,000; hand loaded into mine cars, 2,000,000; and a small tonnage by continuous mining, Duckbills or other self-loading conveyors, and scraper loaders.

The ninth group, "Hand loading only," is compared with mechanical loading in 1958, by states, in table 7. Average productivity by states, at bituminous coal and lignite mines with mechanical loading, varied from 3.64 tpd per man in Oklahoma to 16.11 in Illinois. Mines with 100-percent hand loading had the lowest tons per man per day in Arkansas (2.74) and the highest in Kentucky (7.23). More than 41,000,000 tons of coal was produced in 1958 from mines employing no loading devices.

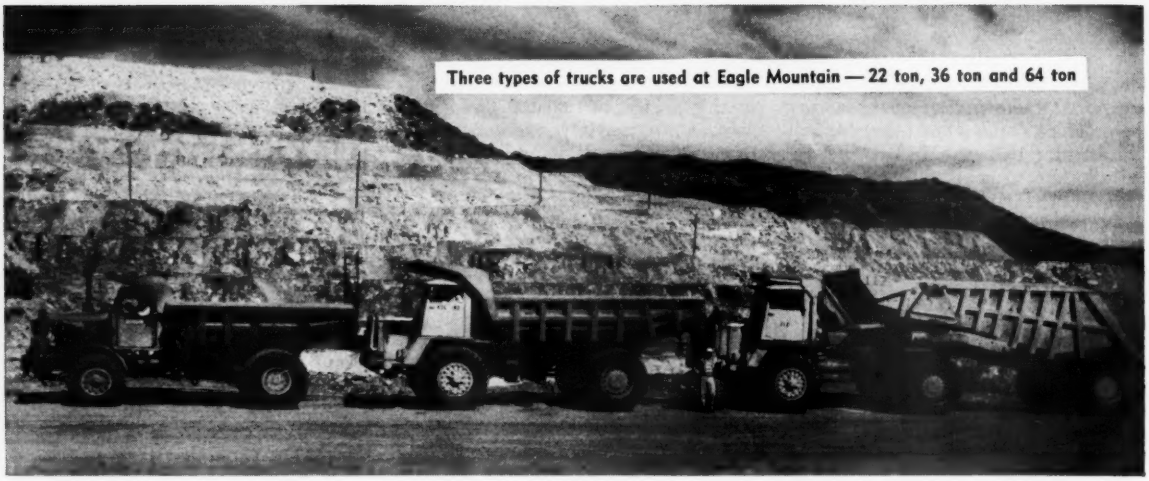
In addition to the 287,000,000 tons of underground production outlined in this report, there were 116,000,000 tons mined by stripping and 7,000,000 tons by auger mining, with productivity rates of 21.54 and 28.15 tpd per man, respectively. Total production of bituminous coal and lignite in 1958 was 410,000,000 tons, and the average productivity for all mines was 11.33 tpd per man.

Table VII. Productivity at underground bituminous coal and lignite mines in the United States, with mechanical loading compared with mines with hand loading only, by states, 1958.

State	Average tons per man per day[1]			Number of mines			Production (thousand net tons)			Percentage of total production		
	Mechanical	Hand	Total	Mechanical	Hand	Total	Mechanical	Hand	Total	Mechanical	Hand	Total
Alabama	7.52	3.50	7.17	32	72	104	8,147	358	8,505	95.8	4.2	100.0
Arkansas	3.96	2.74	3.82	12	4	16	78	7	85	91.9	8.1	100.0
Colorado	6.94	3.52	6.67	61	40	101	2,445	106	2,551	95.8	4.2	100.0
Illinois	16.11	3.56	15.63	51	23	74	23,169	204	23,373	99.1	0.9	100.0
Indiana	12.61	5.10	12.21	20	18	38	4,599	104	4,703	97.8	2.2	100.0
Iowa	10.98	3.61	4.93	3	20	23	100	151	251	39.9	60.1	100.0
Kentucky	11.00	7.23	9.63	161	1,612	1,773	33,537	12,585	46,122	72.7	27.3	100.0
Maryland	4.42	3.67	3.95	7	43	50	144	201	345	41.7	58.3	100.0
Montana (bituminous and lignite)	6.88	5.09	6.60	9	9	18	176	25	201	87.8	12.2	100.0
Ohio	11.95	3.83	9.81	44	121	165	8,254	945	9,199	89.7	10.3	100.0
Oklahoma	3.64	4.05	3.66	5	6	11	350	19	369	94.8	5.2	100.0
Pennsylvania	8.77	3.77	8.03	246	563	809	44,461	3,329	47,790	93.0	7.0	100.0
Tennessee	10.11	4.61	6.10	18	397	415	1,957	2,395	4,352	45.0	55.0	100.0
Utah	10.19	5.43	10.17	40	8	48	5,315	13	5,328	99.8	0.2	100.0
Virginia	9.64	6.62	7.96	71	1,254	1,325	13,154	11,271	24,425	53.9	46.1	100.0
Washington	5.20	4.63	5.15	5	5	10	230	17	247	93.1	6.9	100.0
West Virginia	10.97	5.60	10.13	368	915	1,283	99,167	9,065	108,232	91.6	8.4	100.0
Other States[2]	7.24	3.18	5.16	13	43	56	550	256	806	68.3	31.7	100.0
Total	10.48	5.77	9.38	1,166	5,153	6 319	245,833	41,051	286,884	85.7	14 3	100.0

1 *Calculated on basis of average number of men working daily. This includes all men engaged in the production and preparation of coal.*

2 *Includes Alaska, Arizona, Georgia, Kansas, Missouri, New Mexico, North Dakota (lignite), and Wyoming.*



Three types of trucks are used at Eagle Mountain — 22 ton, 36 ton and 64 ton

Large Truck Haulage at Eagle Mountain Mine

By MARTIN J. HUGHES
Manager
Eagle Mountain Mine
Kaiser Steel Corp.

In 1948, 15-ton trucks serviced pit shovels, but increasingly larger units were needed as the pit expanded. Twelve 64-ton semi-trailer end dump trucks are now in the company's fleet and haulage costs are down as much as 31 percent when compared with a 22-ton unit

KAISER Steel Corporation's Eagle Mountain mine lies in the Colorado Desert 60 miles east of Indio, Calif., and 164 miles from the Fontana steel plant. The mine is in a typical desert area at an elevation of about 1400 ft. In the winter, although temperatures occasionally drop to 25°, they are usually above freezing. At times during the summer temperatures rise to 120° but the average is about 95°. Rainfall, the majority of which comes in the summer months as cloudbursts, is only about two in. per year. However, an adequate water supply is available from wells in the Pinto Basin which is about 7 miles from the mine.



The iron ore occurs in a series of over 60 ore bodies in a mineralized zone in metamorphic sedimentary rock. This zone varies from one quarter of a mile to one and one quarter miles wide and extends for a distance of over six miles in an east-west direction across the northern part of the Eagle Mountains.

Stripping Ratio of 3.2 to 1

Kaiser is currently mining in the east end of the property. When operations were started in 1948, they were confined to the Bald Eagle pit which lies 3000 ft west of the present mining

area. In 1951 operations started in the North-South pit, which is part of the area now being worked. During the past three years, an extensive exploration program has been carried out. This program resulted in the proving of additional tonnages which required the redesign of the pit. The redesigned pit, which is known as the East pit will be 8400 ft long, 2400 ft wide, and at its deepest point it will have a depth of 1300 ft. It will include the areas which were covered by both the North-South pit and the Bald Eagle pit. The stripping ratio will be 3.2 tons of waste to one ton of ore.

Current mining operations are on two ore bodies, the north and the south, which will be mined in one pit. The ore bodies dip at approximately 45°. The hard, dense ore withstood erosion and consequently forms the backbone of ridges, since the adjacent waste material suffered erosion. This makes it possible to evolve an economical method of mining. For many years waste will be hauled either on level or on a down grade.

Grades Will Approach 16 Percent

Truck haul roads are 70 ft wide and are built on a 7½ percent grade. In the ultimate bottom of the pit these roads will be narrowed and brought to 16 percent grade for final mining of the deepest ore. The primary crusher, a 66 in. by 84 in. Buchanan jaw crusher, is presently located at the 1500 ft elevation. Ore above this elevation has been worked out and presently ore is being hauled up from the 1365 ft elevation. During the next year, a new 60 in. gyratory crusher will be installed at the 1355 ft elevation where it will remain for the life of the pit. The ore above this elevation will be hauled down to the crusher, whereas ore for at least three benches below the 1355 ft elevation will be hauled up to it. That ore which lies at deeper levels in the pit will either be hauled to the crusher by trucks or by means of a skip hoist.

Mining operations were started on the top bench where the haul road crosses the bench elevation. Work on each bench is started at the intersection of the road and the bench elevation. Naturally, when benches are being opened, tight working conditions are encountered by both the shovels and the trucks.

Six Bucyrus-Erie shovels, one Model 120-B, two 150-B, two 190-B, and one 88-B, are presently used at the Eagle Mountain pit. Ten shovel shifts per day are being worked and the average daily production is 68,000 tons. Shovels are equipped with 4½, 5½ and 8 yd dippers. Drilling and blasting are done by conventional methods and every attempt is made to obtain good fragmentation. This results in both good shovel loading and good truck hauling conditions.



Eight-yd shovel loading 64-ton truck. Tractors are equipped with either 400 hp or 600 hp engines — the 600 hp unit has proved exceptionally adaptable to hauling up adverse grades and to working under unfavorable conditions

When the Bald Eagle pit was first opened, a fleet of 15-ton Euclid trucks was used. These trucks were equipped with 165 hp motors and conventional equipment, and since they were used for hauling downhill, they were equipped with Hydrotarders. These trucks were later replaced by 22-ton Euclids which were also furnished with Hydrotarders. Even though the 15-ton trucks are no longer working at Eagle Mountain, 12 of the 22-ton units are still in use and are doing a good job.

15 and 22-Ton Trucks Replaced

With the introduction of the 150-B shovel in 1952, it became apparent that the 15 and 22-ton trucks were not large enough to service the shovels and obtain the required speed and overall efficiency of operation. In order to match the productive capacity of these shovels, a 35 to 45-ton truck is required. Since the North-South pit which was then being worked was small, and since the trucks were required to work in confined areas which caused much tight turning, three-axle trucks were not desirable. Therefore, it was determined that a two-axle unit was needed.

In 1955 six Kenworth model 803-A trucks were purchased. These machines have two axles and all wheels are equipped with 1800 by 33 in. tires. In order to handle the payload on only two axles, both are of heavy construction with the front axle rated at 50,000 lb load and the rear axle rated at 100,000 lb load. The body has a struck capacity of 24 yd and rated payload is 36 tons. Since the mining plan called for only level or downhill hauls, the trucks were equipped with 335 hp motors rather than the standard 400 hp motor. At present, waste is moving out of the pit on level or downhill grades while ore is moving uphill to the crusher. Therefore, both engine power and braking capacity are of paramount importance in the haulage unit. Experience has shown that the 335 hp engine was sufficient for the original conditions, but it is not quite large enough for present operating conditions. Therefore, plans call for replacement of the 335 hp engines by 400 hp engines.

Generally speaking, the 36-ton trucks have done a good job. In spite of some necessary changes in the original design of certain parts of the unit, maintenance and operating costs have been well within acceptable limits.

Eight-Yd Shovels in Expanded Pit

In 1957 the planned addition of a fourth blast furnace to the Fontana steel plant made it necessary to prepare for an equivalent expansion of the productive capacity of the Eagle Mountain pit. In order to allow for this expansion, it became necessary to open up deeper sections of the ore body and to expand the stripping

ratio from one ton of waste to one ton of ore to 3.2 tons of waste to one ton of ore.

Eight-yd shovels were selected to handle the loading of waste. A study of shovel dipper capacity, material weight and the proposed pit plan indicated that for the most efficient and low cost operation, the shovel should work with a 64-ton truck or an 84-ton truck. Neither of these units was then available. The idea of using the 84-ton truck was quickly shelved because of inadequacies of certain components such as transmissions and tires. No standard truck with a rated capacity of 64 tons was available and none of the manufacturers wished to produce a three-axle unit of this size. Therefore, it was determined that the semitrailer principle should be used. Naturally, the design of such a large end dump semitrailer presented some problems. These were successfully solved and 11 Kenworth model 803-B trucks were purchased and delivered between July 1957 and July 1958.



Sixty-four ton semi-trailer truck in full dump position. Average tire life on these units is 2075 hr, and it is interesting to note that trailer tires have almost the same life as tractor tires

64-Ton Trucks Introduced

The semitrailer trucks are the most interesting units which are used at Eagle Mountain. They have a struck capacity of 40 yd and rated capacity of 64 tons. These units are equipped with 400 hp Cummins engines, Twin Disc torque converters and Fuller transmissions. The truck consists of a standard model 803 tractor to which a fifth wheel and an end-dump trailer have been added. The tractor is equipped with six 1800 by 33 in. tires, and the trailer is equipped with four of the same tires.

The trailer is dumped by a pair of hydraulic cylinders, which actuate a scissors type arrangement which in turn dumps the trailer by pulling the truck and the trailer wheels together in a manner similar to that used by a cable-dump trailer. Since this arrangement does not require the use of a sub-frame or other similar structures, it was possible to design the trailer with a 40 yd capacity and still maintain a low center of gravity and a relatively low hopper which is easy to load.

In October 1958, a twelfth semitrailer was delivered to Eagle Mountain. This unit is equipped with a 600 hp engine and a semiautomatic transmission. The rest of the truck is the same as the other 11 units.

At Eagle Mountain the semitrailers have been very successful. They are highly maneuverable and easy to drive. No driver resistance was encountered and almost any good truck driver can handle one of these units after a very short instruction period. No tire scuffing has been experienced. Although these units will be used mainly for hauling waste on level roads, they have been used on pioneering and construction work where eight to ten percent grades both with and against the loads have been encountered. Under all conditions, the trucks performed beyond expectations and as well as any end dump truck which is used at the property. The 600 hp unit has proved to be exceptionally adaptable to hauling up adverse grades and to working under unfavorable conditions.

Fleet Consists of 30 Trucks

At present, the Eagle Mountain fleet consists of 30 trucks. Twelve of these are of 22 tons capacity, six are of 36 tons capacity and twelve are of 64 tons capacity. In addition, two more 64-ton trucks are on order.

The 22-ton trucks are used for pioneering the pit, for construction work, for hauling up hill and for use in small areas where the larger trucks cannot be efficiently used. In spite of the fact that they are the oldest trucks in the fleet, they are very dependable and they are an invaluable supplement to the fleet of larger machines.

The 36-ton trucks are presently being used for handling waste on the level grades where the previously mentioned lack of horsepower does not adversely affect their performance.

The 64-ton units are being used primarily for handling waste. However, it is often necessary to use them for hauling ore up adverse grades to the crusher. Due to the fact that the East pit is in the early stage of development, these machines must often haul the waste material both up and down grades of from eight to ten percent. In all cases they have done an excellent job and it can be stated that they are very well suited to the work which they are doing.

Haul Roads Surfaced With Tailings

Tire life at Eagle Mountain is affected by severe heat and by the extremely abrasive character of the rock. Haul roads are not paved, but they are built on a rock base and are surfaced with fine tailings. This results in a road which is equal to or better than pavement. The average tire life on the 22-ton trucks is 2250 hr, on the 36-ton trucks it is 2060 hr, and on the 64-ton trucks it is 2075 hr. It is interesting to note that the trailer tires are giving almost exactly the same life as the tractor tires.

The introduction of the large trucks has resulted in a considerable saving in haulage costs. During 1958, the cost of hauling with the 36-ton trucks was 87.9 percent of the cost of hauling with the 22-ton trucks, and the cost of hauling with the 64-ton trucks was 68.8 percent of the cost of hauling with the 22-ton trucks. These percentages are based upon costs which were obtained under conditions that were equal with respect to haul lengths, grades and road conditions.

The material which is hauled at Eagle Mountain is highly abrasive and various types of truck body liners have been tried. The usual rails and angles proved to be of short life and continually in need of maintenance. Almost every conceivable type of truck bed liner has been tried, and a liner which consists of one in. Kaisoloy wear resistant plate was finally settled upon. The plate sections are so designed that they can be removed and replaced without disturbing adjacent sections.

In the future, further expansion at Eagle Mountain will be necessary. Past experience proves that the larger trucks, when teamed with large shovels, result in reduced overall costs and increased overall efficiency. Although the 64-ton truck is doing an excellent job, it is not the ultimate, and as expansion occurs every effort will be made to obtain bigger and more efficient trucks for the large scale movement of ore and waste from the pit. It is hoped that the engineering of tires, transmissions and other components will keep pace with the need for larger equipment.

LOCK WASHERS INDICATE ROOF BOLT TENSION

A report by the lock washer industry to the AMC Roof Action Committee on the feasibility of using lock washers as a roof bolt tension indicating device

SIX manufacturers of helical springs —lock washers to almost everyone—have worked together in the development of a mine roof bolt tension indicating washer, or T.I.W. as the washer manufacturers prefer to call it. The Committee on Roof Action of the Mining Congress, the U. S. Bureau of Mines, roof bolt manufacturers and individual mining companies have also cooperated in this effort.

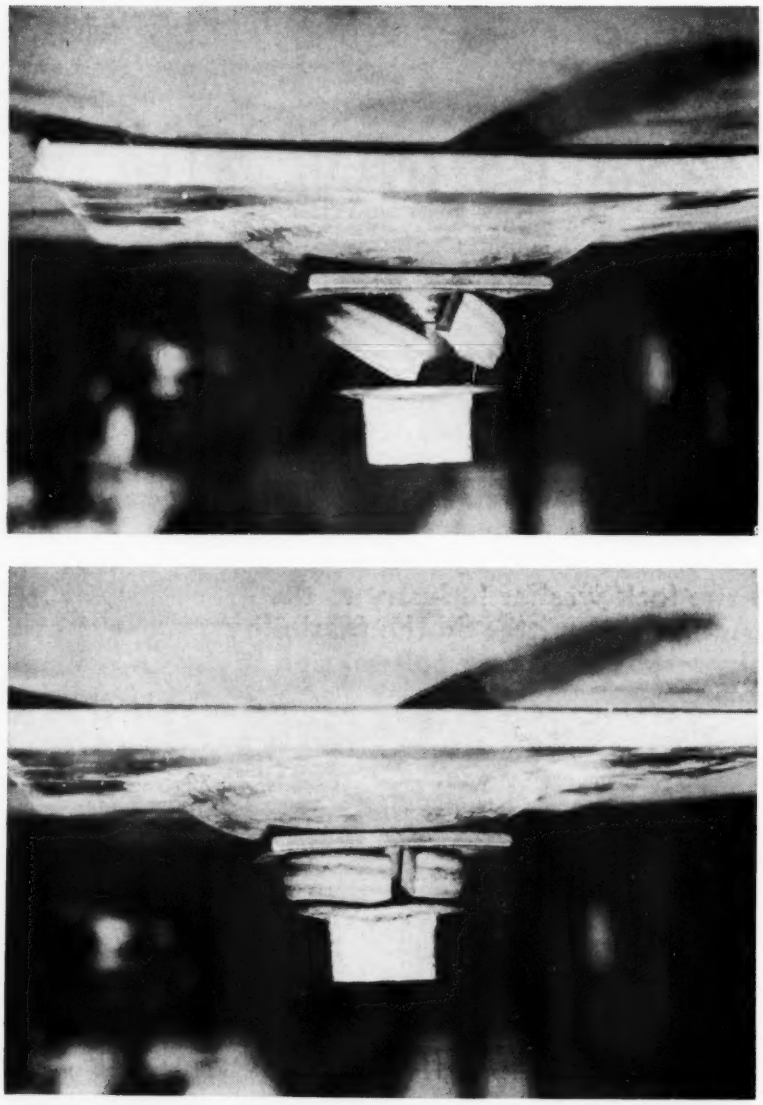
It is generally agreed that the method of assessing the tension of mine roof bolts by determining a torque-tension relationship and then measuring the torque needed to loosen a bolt is, at best, an approximate method. There are so many factors which can effect the torque (which is dependent on overcoming friction between the bolt and the plate) that the torque-tension relation may vary as much as 50 percent.

The advantage claimed for using lock washers to measure tension is that the tension is measured directly. The washers referred to are actually helical springs of one convolution. The free height, internal diameter, and section are designed so that under compression of the bolt head and roof plate the washer will be compressed into a horizontal plane when the tension in the bolt reaches a desired load. Now the problem becomes one of designing a washer which will close under a predetermined load with an acceptable accuracy.

As far as design is concerned, there is a definite mathematical formula which takes into account all the variables encountered in designing a helical spring, and a washer can be designed for almost any load and any diameter of bolt.

To assure an acceptable accuracy, participating lock washer manufacturers have suggested a specification and method of quality control which is included in this report. These specifications will control the manufacture and the testing of the washer in the plants where they will be manufactured. By strict control of chemistry, dimensional tolerances, and methods of testing, the manufacturing companies will be able to guarantee that the washers will close at specified loads—tests to date have shown that the washers will indicate loads within a tolerance of plus or minus ten percent.

For about a year the lock washer industry has been cooperating in a program of research and development to come up with a tension indicating washer that will meet the demands of the mining industry. Test installations have been made in mines throughout the country with some interesting results. In many instances it has been found that the washers did not close before a preset bolting machine cut off at what was thought to be the proper torque to deliver the desired roof bolt tension. Investigation always showed that the washers were not at fault, but instead that either the bolting machines were not properly adjusted to deliver the desired torque or that the torque was not



These two views show a lock washer, roof bolt assembly before and after the bolt is tightened

properly selected.

In test installations to date, washers having a 6000-lb or 8000-lb closing load have been used. One thing that has been apparent is that the washer in all cases closed at approximately the calculated closing load. The word, **approximately,** should be stressed as the point of closure depends on the operator of the bolting machine. Since this is a visual determination, there naturally can be a variation between the point at which one operator considers the washer closed and another may consider it closed—but tests have shown that this variation is no greater than plus or minus ten percent.

The advantage of having all bolts in a bolting pattern within ten percent of the desired tension is apparent. Each bolt is then carrying its proportion of the load. If the bolting machine operator cuts off his machine when the washer closes, the danger of overstressing the anchorage is eliminated. Because the washer will begin to open when the tension in the bolt drops below the tension required to hold the washer closed, it is possible to determine by visual inspection when bolt tension is relaxing—eliminating the need for falling back on the admittedly erratic torque-tension relationship.

As is always the case with new ideas when first tried out, the test installations have turned up problems. These include the following:

1. In metal mines of the west, the performance of tension indicating washers has been erratic because of the jagged, non-uniform condition of the roof and because the majority of the bolts are not installed at right angles to the plane of the roof. The holes were usually drilled at all angles, and on tightening the bolt, the bolt heads were rarely tightened flush with the roof plate but were generally cocked. This meant that unless the washer could be positioned and kept so that its split was at a point where it was bearing both against the flashing of the bolt and the roof plate, it had no effect whatsoever.

2. In certain instances an undesirable feature has been that the washer spins around when the bolt is tightened, and the ultimate position of the split cannot be seen by the operator of the bolting machine. In such cases, the operator either has to lose time by walking around to check if the washer has closed, or twist the bolt around for possibly another half revolution in order to bring the split into view. This naturally causes an increase in tension of the bolt over the desired tension. In other cases it has been found that this spinning does not take place; it appears to depend on the type of roof plate that is being used.

This problem is being worked on and a solution seems to be in the offing. It may be possible that a little indentation can be stamped in the mine roof plate at the time it is being stamped. The edge of the split of the washer would then catch on this indentation and prevent it from spinning.

3. If, once the bolt has been tightened to the required tension to fully close the washer, the bolt loses some of its tension, the washer will open. It is possible on reclosure that the washer will close at a load below the designed load. This is because of the initial set that takes place within the material on compression. The problem can be overcome, as it has been in the case of similar washers used in the railroad industry, where at the time of manufacture the washers are compressed initially, and the initial set relieved completely.

4. Finally, a problem which has arisen and which there has not yet been an answer, is that in certain cases when bolt tension has relaxed, or in test installations when the tension has been relieved by loosening

SUGGESTED SPECIFICATION FOR HELICAL SPRING MINE ROOF BOLT TENSION INDICATING WASHER (T.I.W.)

General Scope: **Purpose of Specification—to protect the consumer by assuring that T.I.W. shall be made in accordance with certain specifications pertaining to quality and testing.**
Also, to establish certain manufacturing practices and provide a uniformity of products without limiting improvements in design and advancements in engineering.

Material: **All washers shall be made of steel by the open hearth, electric furnace, or crucible process, with the following minimum physical properties:**

Tensile Strength Min.	Yield Point Min.	Elongation

(These values are yet to be determined)
All shall be heat treated, oil quenched, and tempered. Tempered washers shall have a hardness of Rockwell "C" Scale 46–54, or Brinnel Hardness 432–543.

Ductility: **Ductility shall be determined by twisting one end of a finished washer through 90 degrees without sign of fracture, while the other end is held securely in a vise, as follows:**

1. **Fasten ¼ of the length of the coil from one end between the jaws of a vise.**
2. **Grip ¼ of the length of the coil from the other end between the jaws of a wrench.**
3. **Rotate the wrench, thus causing the end of the coil to describe a circle about the middle point of the coil as a center so that open ends of washer shall pass each other.**

Finish: **The section shall be nominally rectangular in section and shape.**

Identification: **Each washer shall be identified with a symbol indicating its closing load, and each shall be identified by the manufacturer with a symbol.**

Method of Testing: **For testing the closing load of tension indicating washers, an approved, calibrated, and tested load cell shall be used. The calibration of the load cell indicator shall be in increments of 100 lb., to a minimum total load of 10,000 lb. capacity on the load cell. Each load cell so used for testing shall be calibrated by an approved testing agency at least twice a year.**
A mine roof bolt shall be inserted through the load cell, the washers placed on the load cell, then a hardened washer placed under the head of the mine roof bolt, and then the mine roof bolt be tightened with a hand wrench gradually until the washer appears closed to the operator. Visual closing shall be that point at which the upper edges of the split of the washer appear to be in one horizontal plane. The load indicated by the load cell shall not vary by more than plus or minus 10 percent from the designated closing load. Three washers shall be selected for visual closing load, and three washers for the hardness test, and three washers for the ductility test from each lot of washers. A lot shall consist of 5000 or fraction thereof.

the bolt, the washer has not shown an indication of opening until the bolt has lost about 40 percent of its installed tension. This means that, with an 8000-lb washer, the washer will not appear to open until the tension has relaxed to 5000 lb. It is the opinion of the lock washer industry that this is not a reflection on the washer because when tested in a compression machine, by tightening the load to 8000 lbs and then reducing it, the washer begins to open as soon as the load drops below 8000 lbs. This has occurred in every case when tested in an industry laboratory, and also when tested independently at West Virginia University.

This, then, appears to be more of a problem of elastic displacement in the bolt and the mine roof plate. That is, when the bolt is tightened, elongation takes place. At the same time, the mine roof plate will distort if it is not bearing fully against the roof. Because of the elongation of the bolt and the elastic deformation of the plate, the washer begins to open only when these two units begin to take up their normal positions. There is also another factor involved, in that the friction existing between the bearing surfaces of the washer and the mine roof bolt and the flashing of the bolt head is such that this frictional resistance may be sufficient to prevent the washer from opening. Only when the tension has been reduced sufficiently to reduce the friction between these two bearing surfaces to the point that the spring in the washer will overcome the friction, will the washer open. The washer as manufactured has a helical shape, which means it is slightly longer than would be a circle of the same radius, but in a horizontal plane, therefore, on compression in to a horizontal plane, the greater circumferential length must be compensated for by an increase in diameter. This calls for a relative movement horizontally between the washer and its bearing members, and also vertically, as the washer moves from its open height to its compressed position.

These are some of the problems that have risen, but they can be overcome. The important property of helical springs is that they will close at a predetermined load. This has been proven in many installations. Therefore, it is now possible to bypass the torque-tension relationship and measure tension in mine roof bolts directly through the use of as simple a device as a lock washer.

[ACKNOWLEDGMENT]

Acknowledgment is hereby made of the efforts of the Lock Washer Industry to design a roof bolt tension indicating washer in cooperation with the mining industry. Special acknowledgment is made to Basil H. Levin, American Nut & Bolt Fastener Co., and J. A. Liddell, The National Lock Washer Co., for their efforts in spearheading the work.



"Have you any cards for some investors who invested too heavily in a mine that petered out too soon?"

Flotation of Some Oxidized and Nonmetallic Ores





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Results of three research projects, either recently completed or currently being carried out at Washington State University are reviewed

UNTIL the last decade, pyrometallurgical processes, such as fuming in the Waelz kiln, were the only commercial processes for the recovery of zinc from oxidized ores. Froth flotation processes have been investigated by many workers resulting in the development of a commercial process now used in several mills in Sardinia and North Africa. This process was apparently developed simultaneously and independently by McKenna, Lessels and Peterson[3] in the United States and by Rey and associates in Europe. The ore is sulfidized and floated at a high pH using an aliphatic amine for a collector. Rey[3,4] states that smithsonite, hydrozincite, hemimorphite and willemite are floated. Sphalerite is also recovered, making the process applicable to partially oxidized ores. Oxide and sulfide lead minerals can be recovered by conventional methods prior to the zinc flotation.

Amine Process in Zinc Flotation

One of the authors (Aitkenhead) had the opportunity of visiting the San Giovanni mill of the Societá Mineraria e Metallurgica di Pertusola near Iglesias, Sardinia, during the summer of 1956. The first commercial application of the amine process was introduced in this mill in 1950 and has been in fairly successful operation since.

The question of markets for oxidized zinc concentrates may arise. Dr. Antonio Caroli, manager of the San Giovanni mill stated that electrolytic zinc plants prefer sulfide concentrates because the oxide concentrates may contain fluoride, causing the deposited zinc to stick to the aluminum cathodes. The oxidized concentrates produced in the Mediterranean Basin are shipped mostly to Belgium and France for thermal smelting. Whether treated thermally or by the electrolytic process, oxidized zinc concentrates would have to be roasted to eliminate carbon dioxide and to oxidize any sulfides present.

A smithsonite concentrate containing 45 percent zinc is equivalent to a sphalerite concentrate containing 56 percent zinc, as they will both yield a calcine containing 65 percent zinc if completely roasted to zinc oxide.

About three years ago a project was started to test this amine process on oxidized zinc ores from the State of Washington. Several hundred bench tests were made followed by three 100-lb per hr pilot runs. Ore from surface workings of Pend Oreille Mines and Metals Co. at Metalline Falls, Wash., was used for the pilot tests, as the bench tests showed this ore to be the most amenable. A lead concentrate was made before the zinc circuit.

Ore was prepared for the pilot plant by passing through two stages of jaw crushing followed by a roll crusher. The screen analysis of the feed to the pilot plant is given in table 1.

Table 1. Screen analyses of feed to pilot-plant

Mesh	Lot A (tests No. 1 and 2)		Lot B (test No. 3)	
	Percent	Cumulative Percent	Percent	Cumulative Percent
+ 3	1.48	1.48	12.84	12.84
+ 4	9.60	11.08	20.62	33.46
+ 6	23.90	34.98	17.44	50.90
+ 8	16.78	51.76	9.85	60.75
+ 10	12.72	64.48	8.60	69.35
+ 14	6.55	71.03	5.39	74.74
+ 20	7.74	78.77	4.99	79.73
+ 28	4.64	83.41	3.78	83.51
+ 35	3.15	86.56	2.78	86.29
+ 48	2.39	88.95	2.19	88.48
+ 65	1.72	90.67	2.11	90.59
+ 100	1.67	92.34	1.70	92.29
+ 150	2.68	95.02	1.87	94.16
+ 200	1.43	96.45	1.41	95.57
+ 270	1.15	97.60	1.13	96.70
+ 325	0.43	98.03	0.61	97.31
− 325	1.97	100.00	2.69	100.00

Since the Pend Oreille ore is finely disseminated, it had to be ground very fine to liberate the zinc minerals. Bench tests indicated that the optimum grind should be about 50 percent through 325 mesh. This fineness was not difficult to attain because the ore is soft. Actually, the grind for the first two pilot runs was too fine, as much as 73 percent through 325. The grind for pilot run No. 3 was about right. Table 2 gives the screen analysis of the classifier overflow for pilot run 3.

Table 2. Classifier overflow—pilot test No. 3

Mesh	Weight Percent	Cumulative Percent
+ 65	2.68	2.68
+ 100	5.02	7.70
+ 150	14.20	21.90
+ 200	11.05	32.95
+ 270	9.11	42.06
+ 325	4.29	46.35
+ 20 micron	26.86	73.21
+ 10 "	6.66	79.87
+ 5 "	10.20	90.07
− 5 "	9.93	100.00

PLATE I

MAIN PILOT-PLANT CIRCUIT

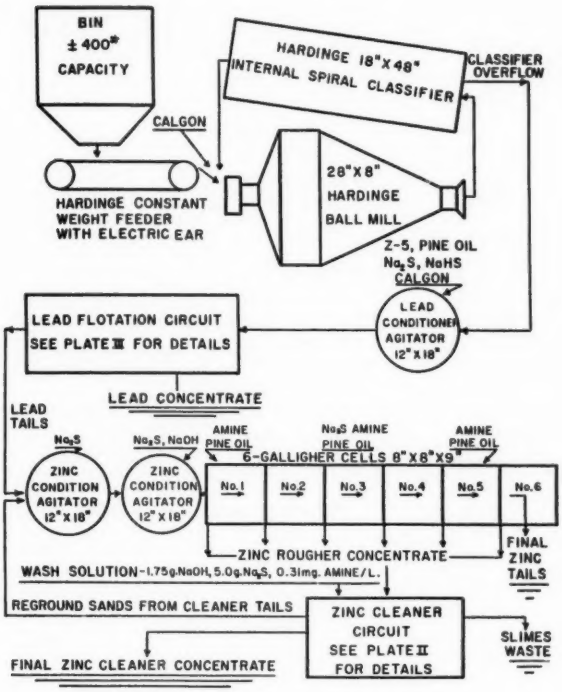
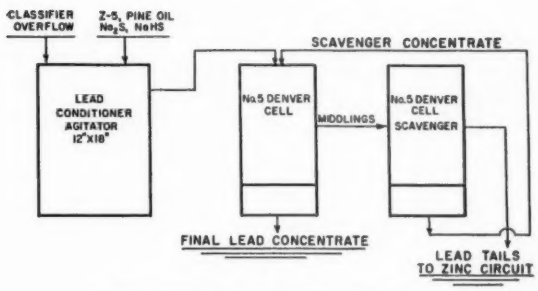
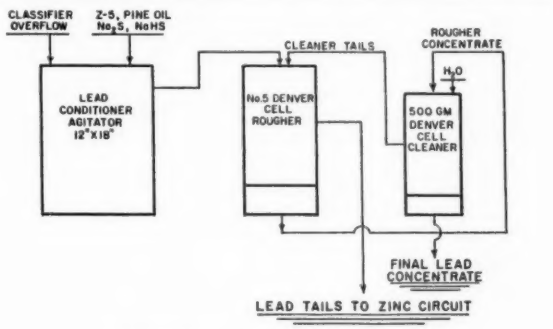


PLATE III



LEAD CIRCUIT USED IN PILOT-PLANT RUNS 1&2



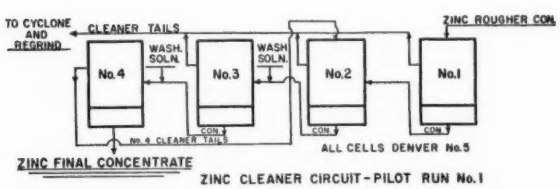
LEAD CIRCUIT USED IN PILOT-PLANT RUN No.3

The principal amine collectors tested for zinc flotation were the amine acetates of cocoa, soya and tallow fatty acids, as well as the straight amines of the latter two. Much of the bench work was done with tallow amine acetates and emulsified tallow amine. These two reagents were better than the other amines used, as they produced better froths and had greater slime tolerance. In this latter respect, the straight tallow amine was the best collector tested. In most of the bench tests tallow amine acetate was used, as it is water soluble and can be fed more accurately. The manufacturer recommends that the straight tallow amine is best fed in a one to one mixture with pine oil. Since this mixture does not keep well, a solution of the amine in ethyl alcohol was used in the pilot plant runs.

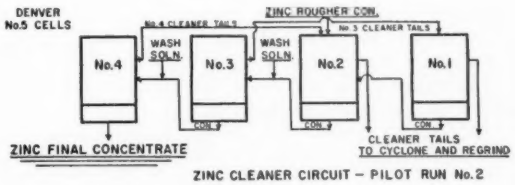
Plate I shows a generalized flowsheet of the pilot plant.

A simple circuit for the recovery of sulfide and oxide lead, two variations

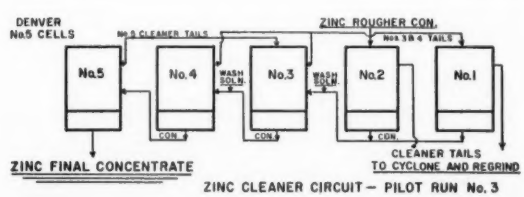
PLATE II



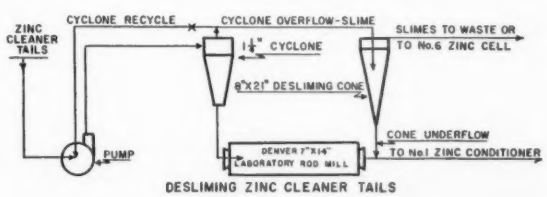
ZINC CLEANER CIRCUIT-PILOT RUN No.1



ZINC CLEANER CIRCUIT - PILOT RUN No.2



ZINC CLEANER CIRCUIT - PILOT RUN No. 3



DESLIMING ZINC CLEANER TAILS

of which are shown in plate III, preceded the zinc circuit. The results from the lead flotation were not satisfactory in any of the pilot tests, probably due to insufficient cell capacity and to the extremely fine grind necessary for the zinc flotation. Tables 3 and 4 give the lead flotation data.

The principal problem in making an acceptable zinc concentrate was the elimination of the gangue slimes. Desliming before concentration, as practiced at the San Giovanni mill, cuts down recovery. Bench tests indicated that washing the concentrate with a solution carrying enough reagents to prevent dropping the concentrate was effective in increasing the concentrate grade. In the pilot runs a wash solution containing 1.75 g (grams) sodium hydroxide, 5.0 g sodium sulfide and 31 mg Armofloat 54–38 per liter was used for washing the concentrate. The cleaner circuit was changed for each of the three pilot plant tests, shown in plate II. However, sufficient data were not obtained to indicate which was best.

Table 3. Concentrates and recoveries from lead circuit

	Pb in Pb conc., %	Zn in Pb conc., %	Pb recovery, %
Pilot-Plant Run 1	14.1	8.7	55.0
" " " 2	29.1	6.3	72.0
" " " 3	58.2	3.1	44.2

Table 4. Reagent consumption for lead

	Pilot-Plant Run		
	No. 1 #/ton	No. 2 #/ton	No. 3 #/ton
Calgon	0.80	0.81	0.50
Sodium sulfide	0.66	0.68	0.81
Sodium hydrosulfide	0.66	0.68	0.81
Pine Oil	0.10	0.10	0.19
Z-5	0.003	0.003	0.004

Conditioning time—approximately 15 min
pH .....9.5 to 9.7

Table 5. Summary of results from the three pilot-plant tests

	Test No. 1		Test No. 2		Test No. 3	
	% Pb	% Zn	% Pb	% Zn	% Pb	% Zn
Heads	1.0	6.2	1.1	6.3	0.7	4.5
Pb Conc.	14.1	8.7	29.1	6.3	58.2	3.1
Zn Conc.	0.7	47.3	1.0	36.3	2.7	44.8
Pb Tails	0.5	—	0.3	—	0.4	—
Zn Tails	0.6	3.0	0.2	2.9	0.2	0.96
Recovery—In Pb Conc.	55.0	—	72.0	—	44.2	—
Recovery—In Zn Conc.	—	55.6	—	59.0	—	80.6

The cleaner tailings were treated by passing through a cyclone and desliming cone to remove the coarser particles for regrinding and retreatment. This step is illustrated at the bottom of plate II. The gain from this desliming and regrind circuit could not be determined accurately, but the fact that the cyclone and cone underflows contained eight and six percent zinc respectively indicates that some beneficial effect must have been obtained, as the cleaner tailings assayed only five to six percent zinc. Significant results from the pilot plant runs are summarized by tables 5 through 10.

Of the ores tested, only ore from surface workings of the Pend Oreille Mines and Metals Co. gave satisfactory results.

The circuit used successfully for the Pend Oreille oxidized zinc ore should be applicable to any ore of this type, provided that the zinc minerals are not too finely disseminated and that too much slime is not produced during grinding.

The economics of the process are questionable for present conditions. It is doubtful that oxidized zinc concentrates would be accepted by the electrolytic zinc plants in the Northwest as long as sulfide concentrates are available.

Flotation of Uranium Minerals and Monazite

Discovery of autunitic uranium ores in the vicinity of Spokane, Wash., led to the inauguration of a research project to investigate the possibility of up-grading these low grade ores by flotation. Various fatty acids tried gave indications that this class of reagents had possibilities. Eventually an aqueous emulsion of stearic acid, kerosene and soap was developed

Table 6. Zinc circuit reagent consumption

Reagent	Where Fed	Test No. 1, lb/T	Test No. 2, lb/T	Test No. 3, lb/T
	Ball Mill & Conditioner	0.8	0.8	0.8
Calgon				
Na_2S	No. 1 Zn conditioner	5.8	5.70	6.1
	No. 2 Zn conditioner	1.1	1.3	0.7
	No. 3 Zn Cell	0.4	0.4	0.4
	Cleaners	2.5	1.0	1.6
	Total	9.8	8.4	8.8
Armofloat	No. 1 Zn cell	0.07	0.07	0.07
	No. 3 Zn cell	0.06	0.07	0.07
	No. 5 Zn cell	0.07	0.08	0.07
	Cleaners	0.007	0.007	0.009
	Total	0.207	0.207	0.219
Pine oil	No. 1 Zn cell	0.16	0.16	0.08
	No. 3 Zn cell	0.02	0.02	0.03
	No. 5 Zn cell	0.03	0.03	0.05
	Total	0.21	0.21	0.16
NaOH	No. 2 Zn conditioner	1.1	1.3	0.7
	Cleaners	0.4	0.4	0.3
	Total	1.5	1.7	1.0

Table 7. Miscellaneous test data

	Test No. 1	Test No. 2	Test No. 3
Hydrogen Ion Concentration cell 1	pH—10.5	pH—10.5	pH—10.8
Percent Solids	25	24 to 32	20
Rate of Feed, lb/hr	100	97–109	104

Reagent Cost (Average for the three pilot tests)	
Calgon	$0.11
Sodium Sulfide	0.76
Sodium Hydrosulfide	0.06
Z-5	0.01
Armofloat 58-34	0.07
Sodium Hydroxide	0.11
Pine Oil	0.03
Total	$1.15

Table 8. Final zinc tailing—size analysis

Mesh	Weight, %	Cumulative %	Zinc, %	Total zinc in tails, % of
+ 65	0	0		
+ 100	1.15	1.15		
+ 150	10.58	11.73	1.12	10.6
+ 200	11.63	23.36	0.98	9.2
+ 270	11.73	34.59	0.23	2.1
+ 325	5.72	40.31	0.28	1.3
+ 20 microns	24.57	64.88	0.40	7.9
+ 10 "	14.55	79.43	1.05	12.3
+ 5 "	13.89	93.32	2.60	27.80
− 5 "	6.68	100.00	5.55	28.8

Table 9. Zinc rougher concentrate—size analysis

Mesh	Weight, %	Cumulative %	Zinc, %	Total zinc in tails, % of
+ 100	1.1	1.1	14.6	1.6
+ 150	4.6	5.7	13.7	5.0
+ 200	4.6	10.3	24.1	8.8
+ 270	3.7	14.0	30.27	8.9
+ 325	5.7	19.7	28.44	12.8
+ 20 microns	23.4	43.1	16.8	31.2
+ 10 "	32.7	75.80	7.0	18.2
− 10 "	24.2	100.0	7.1	13.5

Table 10. Zinc cleaner concentrate—size analysis

Mesh	Weight, %	Cumulative %	Zinc, %	Total zinc in tails, % of
+ 100	nil	—	—	—
+ 150	2.42	2.42	49.0	2.61
+ 200	6.76	9.18	48.4	7.21
+ 270	9.50	18.77	47.5	10.04
+ 325	8.68	27.45	47.3	9.05
+ 20 microns	43.59	71.04	46.5	44.66
+ 10 "	13.12	84.16	45.1	13.04
+ 5 "	10.39	94.55	41.9	9.59
− 5 "	5.45	100.00	31.7	3.80

which acts as an efficient collector for autunite.

More recent investigations of the application of the stearic acid-kerosene-soap emulsion shows that it has interesting possibilities for the flotation of minerals other than autunite. It has been tested on a pegmatitic uraniferous ore, containing uraninite and uranophane, from Ferry County, Wash., with some success. It will float monazite and apatite. Under certain conditions it will float chrysocolla. This will be discussed later in this report.

Unfortunately, like fatty acids in general, the stearic acid-kerosene-soap emulsion is not selective and only in some favorable cases produces high grade concentrates. An example of this lack of selectivity is the autunitic ore from Maryvale, Utah, which requires a prohibitive excess of the reagent and at best produces a low grade concentrate. Ores containing ferruginous minerals invariably yield low-grade concentrates.

The most favorable results were obtained from granitic ores from Mount Spokane. These ores gave concentrates containing up to 19 percent uranium oxide.

The collector emulsion found to be most effective was made as follows: one g of stearic acid and one g of sodium oleate were dissolved in 100 ml of boiling water, then 1.5 ml (1.2 g) kerosene was added and the mixture shaken in a stoppered flask until cool. The quantity of reagent used varied from one to three lb stearic acid, one to three lb sodium oleate and 1.2 to 3.6 lb kerosene per ton of ore.

The test procedure was to grind 650 g of ore with 650 ml water in a laboratory rod mill, then to remove the water by filtration. The ore was then conditioned by agitating in a stainless steel beaker at 60 percent solids, first with sodium hydroxide, then with the collector emulsion and finally with sodium silicate. After conditioning the pulp was transferred to a laboratory flotation cell and floated at a pH of eight to nine and a pulp density of 26 percent. A frother was used when necessary.

Table 11. Examples of uranium flotation

Ore	Reagents, lb per ton						Heads	Conc.	Tails	Recov.
	NaOH	Sod. Sil.	Stearic	Sod. Oleate	Kerosene	Frother	$\%U_3O_8$	$\%U_3O_8$	$\%U_3O_8$	%
1*	0.15	0.3	1.0	1.0	1.1	0.18	0.39	12.04	0.043	89.3
2*	0.6	0.75	3.0	3.0	3.6	0.15	0.19	0.73	0.024	90.3

* Ore No. 1 was a granite from Mount Spokane containing autunite.
Ore No. 2 was a pegmatite containing uranophane and uraninite.

Table 12. Example of monazite flotation

Ore*	Reagents, lb per ton						Heads	Conc.	Tails	Recov.
	NaOH	Sod. Sil.	Stearic	Sod. Oleate	Kerosene	Frother	%RE Ox.	%RE Ox.	%RE Ox.	%
	0.6	0.75	3.0	3.0	3.6	—	1.77	16.36	0.04	98.1

* The ore was a mixture of monazite and silica sand containing 1.77% rare earth oxide.

Table 13. Examples of chrysocolla flotation

Ore		A*	B*	C*	D*
Heads	% total Cu	—	0.98	1.60	3.14
	% oxide Cu	1.13	0.75	1.48	0.15
	% Fe	—	—	0.57	3.31
Conc.	% total Cu	—	10.2	13.1	18.67
	% oxide Cu	26.86	7.86	12.0	—
Recov.	% total Cu	—	81.2	90.0	98.04
	% oxide Cu	85.10	81.7	89.0	—
Reagents, lb/ton					
H_2SO_4		0.21	0.21	0.21	0.21
$Na_2S \cdot 9H_2O$		0.33	—	—	—
Na_2S (60% flake)		—	0.165	0.165	0.165
Aerofloat 31		0.115	0.115	0.115	0.115
Reagent 404		0.33	0.495	0.495	0.495
Pine Oil		0.06	0.06	0.06	0.06
Reagents (Stage additions)					
Na_2S		—	0.10	0.50	0.10
Aerofloat 31		—	0.046	0.230	0.046
Reagent 404		—	0.165	0.825	0.165
Pine Oil		—	—	0.30	0.06
pH		7.9	8.1–8.5	7.5	5.5–5.8

* Ore A was synthetic, chrysocolla and silica sand.
Ore B was from the Loon Lake copper property north of Spokane. Minerals identified were azurite, malachite, chrysocolla and chalcopyrite.
Ore C was another sample of Loon Lake ore.
Ore D was a sulfide copper ore.

Table 14. Flotation of Chrysocolla using stearic acid-kerosene-soap emulsion

Ore*	Reagents, lb per ton							Heads	Conc.	Tails	Recov.
	NaOH	Sod. Sil.	Stearic	Sod. Oleate	Kerosene	B-23	Na_2HPO_4	%Cu	%Cu	%Cu	%
1	0.6	0.75	3.0	3.0	3.6	0.05	none	2.27	4.68	1.45	52.6
2	0.6	0.75	3.0	3.0	3.6	0.05	1.0	2.20	12.56	0.25	90.4

* Both ores were a mixture of 50 g chrysocolla and 600 g silica sand.

Flotation of Chrysocolla

Chrysocolla, copper silicate, is a difficultly flotable constituent of most oxidized copper ore-bodies. It can occur in crystalline form, but is usually cryptocrystalline and of variable composition. The Inspiration Copper Co. crysocolla, used in the tests described below, varies from deep bluish green, soft and brittle material, to silica stained slightly bluish by the presence of small amounts of copper. It contains on an average 22.6 percent copper.

The chrysocolla present in most oxidized copper ores causes low recovery in flotation concentration. It is recovered by acid leaching; therefore, leaching is used in many cases where flotation would be preferable if the chrysocolla could be floated along with the other oxidized and sulfide minerals.

One of the authors (Jaekel) discovered a method for chrysocolla flotation in 1951. However, it was very sensitive and difficult to control. Further study and test work in 1956–1957, using the same reagents, resulted in an improved process which is fairly stable and permits considerable variations in the quantities of reagents. The process, recently published[11,12] is briefly discussed in the following paragraphs.

It should also be noted that a process using sulfidization, copper sulfate and 2-mercaptobenzothiazole was recently patented by Nathaniel Arbiter.[17]

Most of the experimental work used a synthetic ore, a mixture of silica sand and chrysocolla. All tests were made in a 600 g laboratory flotation cell. The pulp density averaged 25 percent solids. The reagents used were sulfuric acid, sodium sulfide, Aerofloat 31, Reagent 404 and pine oil. The addition of reagents and conditioning time in the cell averaged about five min and the flotation time was three to eight min.

Table 13 shows the results from a synthetic ore, two natural oxidized ores and a sulfide ore. It will be noted that the sulfide ore gave exceptionally good results, indicating that the process should be applicable to partially oxidized ores.

Returning to the stearic acid-kerosene-soap emulsion effective for the flotation of autunite, monazite and apatite, it will be noted that these three minerals are phosphates. It seemed possible that after conditioning with a soluble phosphate, other minerals might become amenable to this reagent. This proved to be the case with chrysocolla. A chrysocolla-sand mixture treated with the emulsion without phosphate showed a slight concentration because the chrysocolla is soft and grinds finer than the silica. No activation of the chrysocolla was noted. When the experiment was repeated adding one lb disodium phosphate per ton of ore, definite activation of the chrysocolla was noted and it floated beautifully. Table 14 shows the effect of the phosphate. These experiments were carried out following the procedure given for the flotation of uranium minerals.

No attempt was made to pin-point the optimum reagent requirement in the above tests, nor were other fatty acid collectors investigated. It is hoped that further work will lead to an economical reagent combination.

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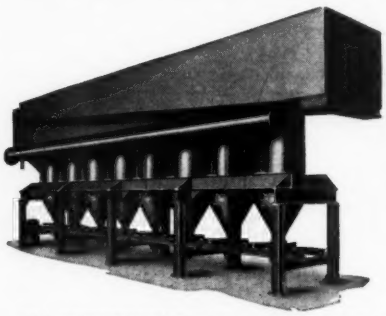
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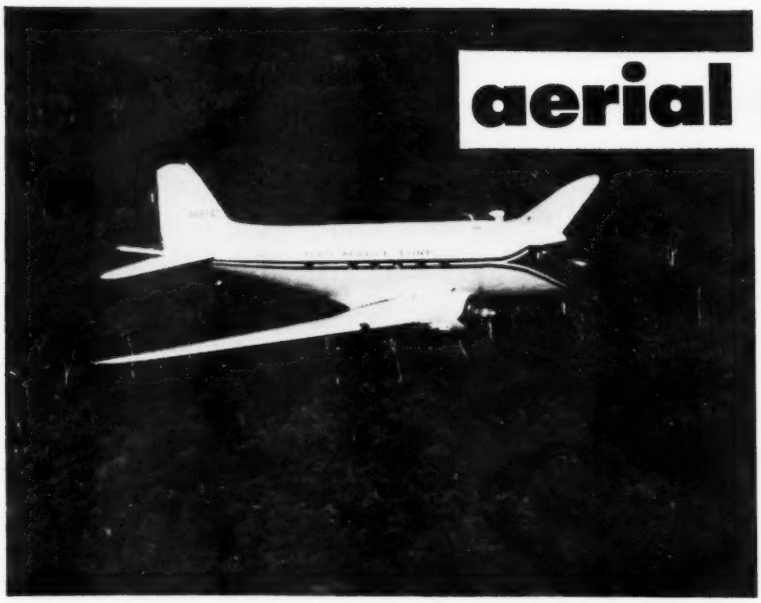
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Electronics in modern aerial mapping



A DC-3 carries out its magnetometer survey over a sea of trees in Surinam, guided by an electronic plane-positioning device

In recent years there have been many innovations in the use of electronics in both field surveying and photogrammetric plotting. These instruments are saving both time and money and have resulted in increased survey accuracies

By GEORGE L. HESS
Aero Service Corp.

DURING the past few years every field has felt the effect of automation. Engineering and photogrammetry are no exception. Electronic devices in use today would have seemed in the realm of science fiction ten years ago. Four of these instruments will be discussed in this article.

Refinement of Radar Applied to Job of Measuring Distances

A certain amount of field survey control is necessary in aerial mapping. One of the newer instruments being used to cut costs and time in field surveys is the Tellurometer.

This instrument applies the refinement of radar to the job of measuring distances. In extremely rough country, it can cut to hours the chaining of a line that might take a survey party four to five days to accomplish. Line of sight is normally required between points to be measured. Measurements can be made up to about 20 miles. Adverse weather, rain or fog will not affect the accuracy of the Tellurometer. It has been used to survey the Aleutians, a very difficult area to map because of the prevalence of fog.

The Tellurometer unit consists of two instruments, a monitor and a slave station. Both instruments are outfitted with an intercommunication system. They are completely mobile and can be carried by one man. It measures a phase comparison between a transmitted and returned microwave signal. The measurement of phase comparison is the time interval required for a microwave signal to travel from the monitor to the remote station and be re-transmitted. By knowing the speed of radio waves, it is then possible to compute distance.

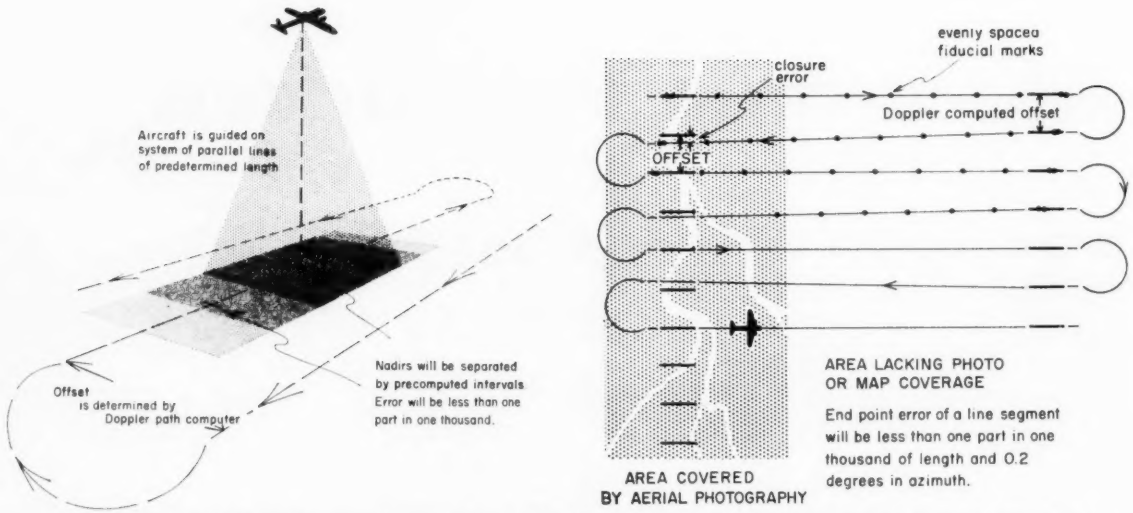
Readings are taken at four different pattern frequencies and recorded on field data sheets. As many as ten different frequencies are recorded on "fine" readings. These are taken to eliminate any reflected waves from objects other than the remote station.

Computational procedures involve an average index of refraction, correction for slope, sea level correction and crystal temperature correction.

Accuracies to within 0.2 ft are believed possible and by limiting distances to not *less* than 2500 ft, closures of better than 1:12,000 may be had. Adjusted surveys done by this method in West Virginia, Pennsylvania and California have been in the order of 1:25,000, well above second order closures.

Photogrammetric Methods Employed to Measure Stockpiles

A problem that has always faced the engineer is the accurate measurement of earth quantities. On large projects where thousands of cubic yards of material are moved daily, a



Most airborne geophysical and photographic surveys require a grid pattern of parallel flight lines. The Radan system's computer is so built that at the end of a flight line, a signal is given to the pilot that the line is completed. A button is pressed and navigational guidance is provided the pilot for executing a turn into the next succeeding line, which will be offset by a pre-determined distance. This sequence is followed until the survey is completed

complete inventory with one "cut-off" date is almost impossible by any method other than photogrammetry. Aerial photography can be obtained of an operation, usually over a span of only several hours. Even though the computations take weeks, the inventory captures all quantities as recorded on the date of the flight.

One of the earliest applications of photogrammetric methods to the problem of volume determinations was measuring coal stockpiles for Philadelphia Electric Co. Results were most impressive, and the method has since been extended from coal piles to ore, pulpwood, and even dredge tailings. All of the work was accomplished by the contour area method where every contour (usually at one or two-ft intervals) is planimetered, and the volume computed by the average end area formula.

Device Records Cross-Section Data for Highway Design

When the Federal Aid Interstate System was approved by Congress in 1956, development work began on automatic recording devices for collecting the vast amount of cross section data points which would be needed for highway design. With this equipment the aerial photography is set up in stereo-plotting instruments for "take-off" of data along cross-section lines at right angles to the highway centerline or the pile. The plotter operator makes readings along each section just as the survey crew did in days gone by. At each change of slope or other significant feature, the offset and ground elevation are automatically scaled and punched in an IBM card or tape at the touch of a button.

By automatic recording, the possible human errors involved in older methods are eliminated. Distance-scaling, transcribing, planimetering, and computing are now confined to the readout device, which is as reliable as an electro-mechanical device can be. With data in punched cards readily available for input to an electronic computer, volume results are available in a fraction of the time previously required.

Ground checks of volumetric computations by the above methods show agreement within two percent. Because of the greater number of points used in the photogrammetric approach, it is probable that, statistically speaking, the answers from the new method are more nearly correct than the ground results.

All of the highway computations performed to date have been based on the use of the individual cross-section method developed when terrain data was taken on the ground by chain, level and rod. Advanced work is now going on to enable use of a vast number of ground points, completely blanketing the area which might be used for the final alignment. This data is stored in a computer with a large memory, and various alignments can be specified as input. Then the computer can be programmed to select the points in the area of the proposed centerline. Complete tabulations of earthwork data can be prepared within the computer itself for each of the routes under study.

Navigation Aids Improve Mapping

Perhaps the most dramatic electronic device employed in aerial mapping and aerial exploration today is Radan, a new Doppler Radar aid to navigation. Although it is used almost exclusively on foreign assignments, it is still of great interest to men engaged in mapping anywhere.

It guides the survey plane over jungle, desert, muskeg, water, ice, without ground reference stations. It permits air surveys over areas previously considered too difficult or downright impossible. Aero first used the device on a rugged 40,000 square mile survey of the Central Sahara Desert in Libya. The exploration was for oil, and the airborne geophysical tool carried was the Gulf magnetometer.

Precise line spacing and positioning were important. Preliminary inspection of the area established that most of the desert lacked recognizable features. One sand dune looks very much like another sand dune. No accurate flight or exact reconstruction of an airborne survey could be made by conventional methods. Since the magnetic data was required at a very early stage in the exploration program, the use of Radan permitted the making of the geophysical survey prior to or simultaneously with the mapping, rather than the usual delay for the completion of aerial photography.

Another application of Doppler



An electronic survey tool, the Tellurometer measures distances of 20 miles with great accuracy

Radan is the use of this plane-positioning system to guide the exploration plane over a "sea of trees" in Surinam. This South American nation is inventorying its mineral resources, with an airborne magnetometer and scintillation counter survey covering 80 per cent of the nation. There are few roads or villages, so Radan is needed to direct the survey over this dense jungle cover. It would require many years on the ground to obtain the data recorded from the air within less than a year.

Aerial surveys demand the most skillful sort of flying. Over the actual survey area, the mapping pilot must fly his plane exactly according to a predetermined pattern of parallel lines. He must be "on line" at all times, within fine tolerances. Where good maps are available, experienced mapping pilots can perform within these limits. But navigation aids are needed over featureless, previously unmapped terrain.

Until now the air-mapper flying such areas used Shoran, Lorac and other ground-controlled systems. Establishing these ground stations and manning them can be costly. The Radan system requires no ground stations. It provides a continuous and highly accurate measurement of the aircrafts' position. Maps can be helpful but are not required. Radan presents a direct reading of the aircraft speed at any moment. Without this quick information, which is supplied solely by Doppler-type navigators, the computing of ground speed involves time-consuming calculations.

No pilot is so perfect that deviations from a chosen path will not occur. The deviations are noted as they occur and accumulated by the computer, so that the off-course error is continuously presented, both visually and on a record tape. The accumulation of error can be kept virtually to zero and the aircraft can be guided with great exactness upon a predetermined straight line.

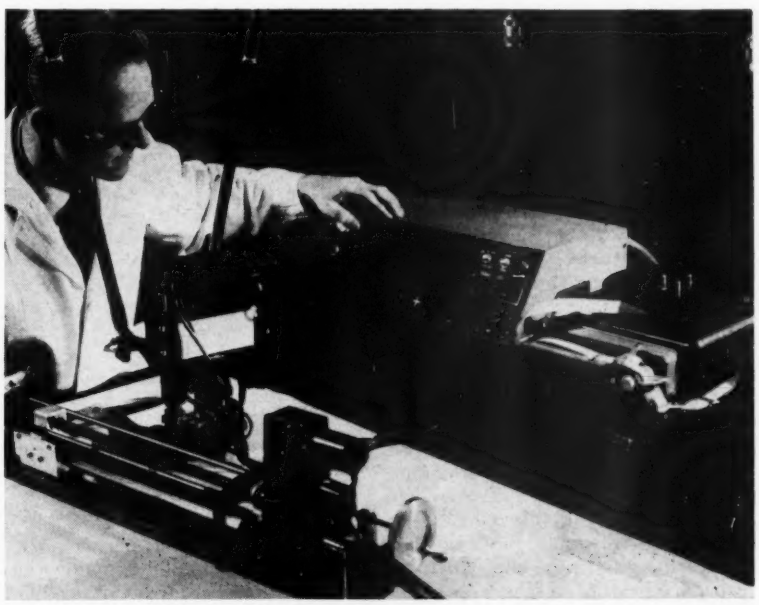
Most airborne geophysical and photographic surveys require a grid pattern of parallel flight lines. The Radan system's computer is so built that at the end of a flight line, a signal is given to the pilot that the line is completed. A button is pressed and navigational guidance is provided the pilot for executing a turn into the next succeeding line, which will be offset by a pre-set distance. This sequence is followed many times until the survey is completed.

Since most surveys are too large to complete in a single day, the Radan serves an additional use—to guide the aircraft from its base to the survey area. This cancels any necessity to seek and search for the often difficult to find "pick-up" from the previous day's survey.

Several dramatic instances have been provided of the dependability of the navigational system. On one flight over the desert, at the end of the day's work and 300 miles from base, the pilot wanted to direct the aircraft home. The course and direction were set into the Radan computer and guidance was solely by reference to the Radan information. At the line-end the pilot found the aircraft was only about 100 yds off the center of the runway.

The dependability of Radan navigation results will mean that the accuracy of surveys derived from these flights will be better than that of visually controlled flights.

All of these electronic aids have been of tremendous benefit in savings of time and costs and have resulted in increased survey accuracies. These important new developments will undoubtedly be followed by other advances in the Sixties—when projects now being studied by aerial mapper become realities.



New digital readout device is attached to stereo-plotter to record cross-section data

SINKING A SMALL CONCRETE-LINED SHAFT IN WYOMING

By KEN NOBS
District Superintendent
Hidden Splendor Mining Co.

Substantial time and effort was expended prior to sinking with a view to minimizing problems that might be encountered in passing through 415 ft of water-bearing and poorly cemented arkosic sandstone

THE Lisbon ore body in the Gas Hills area of Wyoming occurs in the Wind River formation of Tertiary Age. The Wind River formation is a very poorly cemented arkosic sandstone. Grain size varies from medium to very coarse. Color is light to medium gray. Lenses and pods of greenish gray siltstone and mudstone are common. Poorly cemented boulder conglomerates, containing boulders up to one ft or more in diameter, are found in the lower half of the formation and range in thickness from one ft to twenty ft. The ore occurs in the lower sections of the Wind River with the best grades and thicknesses nearest the contact with an underlying impervious siltstone. This underlying material has been tentatively identified as the Mowery formation of Cretaceous Age. The Wind River formation is approximately 415 ft thick in the area with which we are concerned and the normal ground water level stands 95 ft below the surface.

The prospect of sinking a shaft in this area and subsequently maintaining it during production presented some problems. Since there have been no other shafts sunk in the immediate area, substantial time and effort was expended prior to sinking with a view toward minimizing these problems.

Pumps Lowered Water Table Before Sinking Began

Upon selection of the shaft site a hole was core drilled near the site to a depth of 520 ft. The purpose was to make it possible to accurately observe in the cores the character of the formation likely to be encountered in shaft sinking, and to establish a reliable calibration for electrical resistivity logging, that was done in this hole and in all exploration holes on the property.

This hole was subsequently reamed and cased with 12 in. ID casing which had been perforated throughout its entire length. A deep well turbine pump was installed for quantity water testing. Testing indicated that a water problem would probably be encountered in connection with sinking of the shaft and the follow-up drainage of the ore to be mined.

It was decided to drill three more 10 in. ID cased wells. The four wells were each located 25 ft from the center of the shaft site and 90° apart. Deep well turbine pumps were set in each well at a depth of 487 ft. Each pump is capable of pumping 350 gpm against a head of 500 ft. The purpose of this arrangement was to minimize water trouble in connection with sinking the shaft and to start lowering the ground water level, with the hope that it could be reduced sufficiently in elevation to eliminate or minimize water difficulty in the initial development work of the mine and its following production activity.

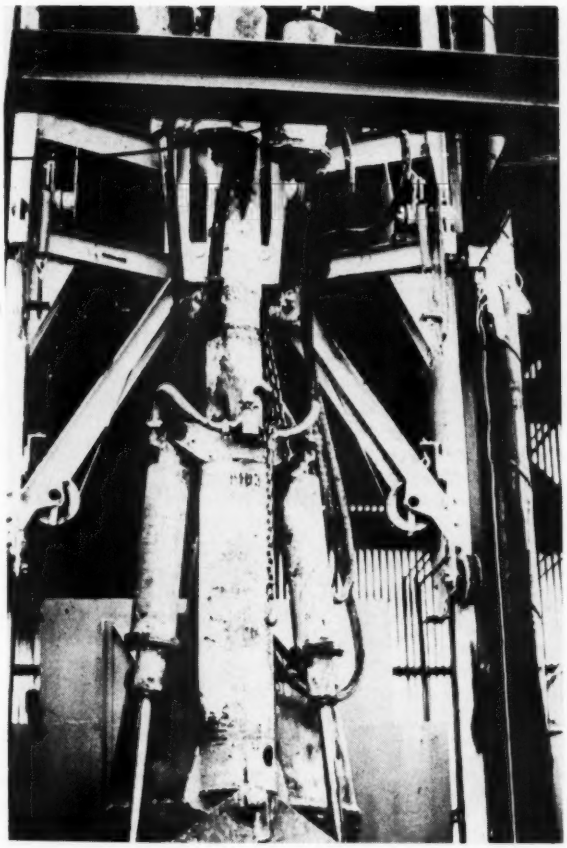
The pumping arrangement has proven very helpful in sinking since the shaft was sunk to 300 ft, or 205 ft below the former ground water level, with no water difficulties that could not be handled by bailing into the hoisting bucket.

After considering several alternate designs it was decided to sink a 7½ ft ID circular, concrete lined shaft. The design is very clean with no obstruction in the shaft other than the two vertical six-in. H beams anchored in the concrete, and steel ladder bolted to the wall. Four by six in. wood guides are bolted to the H beams. Air, water, and pump lines and the counter-weight tube are cast in the concrete leaving the shaft wall clear. The counter-weight tube is used during sinking for ventilation. A temporary six-in. line is carried down the shaft for placing concrete. Concrete wall thickness is nine in. except for a bulge in the area where the pipes and counter-weight tube are located. The calculated amount of concrete per foot of shaft is 1.18 yd, whereas the actual concrete poured for the first 340 ft of shaft was 1.28 yd per ft.

Advantages of Circular Shaft

This particular shaft design was selected because it would: 1) Comfortably accommodate the six ton skip required for mine production; 2) require the minimum excavation and such excavation being circular it would be less likely to cave or slough prior to concreting; 3) give an ideal section for ventilation; 4) give maximum possible open area for lowering equipment into the mine; and 5) reduce shaft maintenance cost to a minimum. The final design was worked out with concurrence and assistance of the Wyoming State Mine Inspector's office.

Plant and equipment required for



A ¼-yd shaft mucker is shown at shaft collar, with crosshead and standard 28-cu ft sinking bucket in background

sinking is fairly simple: a 600 cfm electric powered compressor with standby diesel powered compressor; a 125 hp, 400 fpm electric powered hoist for sinking bucket and safety crosshead; a gasoline powered auxiliary hoist for handling the mucker and shaft forms; a ½ yd concrete batch plant; and a ventilation fan complete surface requirements. Diesel generators are available to run the hoist or pumps in the event of a commercial power outage.

Concrete Poured in Increments of Five-Ft

The most important items of equipment for the shaft itself are the steel forms. These are made up in two main sections each in the form of a half cylinder 20 ft long. Each of these sections is so constructed that it can be shortened so that it is possible to pour not only the full 20 ft of shaft, but 15 ft, 10 ft or 5 ft depending on ground conditions.

A standard 28 cu ft sinking bucket is used with the ¼ yd Cryderman shaft mucker. The safety cross-head is unique in that the hoisting cable is off-set one ft from a vertical plane through the shaft guides in order to let the bucket and the cross-head clear the mucker in the shaft. Drilling is done with standard sinkers using ⅞ in. hexagonal steel and steel throw-away bits. Electric caps, usually wired in parallel, are used for blasting. A slow speed powder in 16 in. sticks, with each hole primed with an eight in. stick of more sensitive powder, has proven the most effective combination for this ground.

The crew consists of three salaried and ten hourly employes. Each shift has a salary supervisor, a hoistman and two men in the bottom. The thirteenth man is the mechanic.

During July 1959, the only full period spent in the shaft, 175 ft of shaft was completed for an average of 6.73 ft per working day. Time cycle break-down and man-hour distribution was as follows:

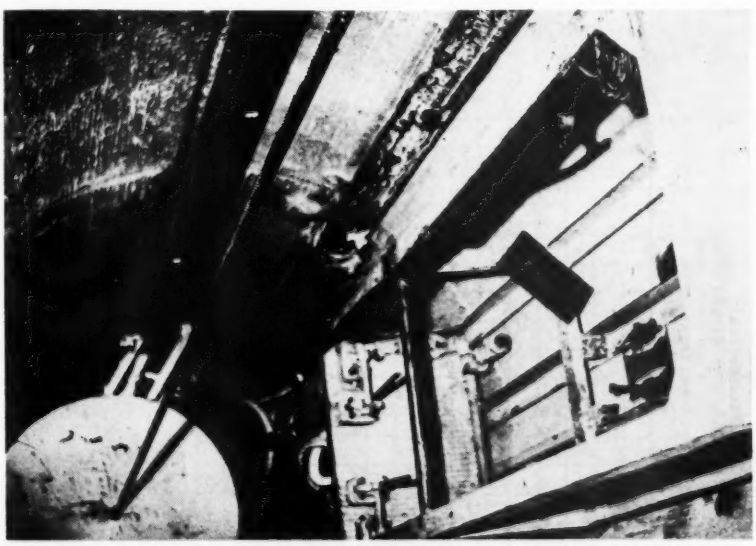
	Drilling and Blasting	Mucking	Forms and Pipes	Pouring Concrete	Guides and Ladder	Misc.
Time Cycle Breakdown	23%	33%	19%	7%	4%	14%
Man-Hour Distrib.	17%	18%	20%	20%	7%	18%

While it is still too early to have the complete cost picture, a number of items on the cost break-down have firmed up to the point where a fair idea can be got of the cost range into which this type of project will fall.

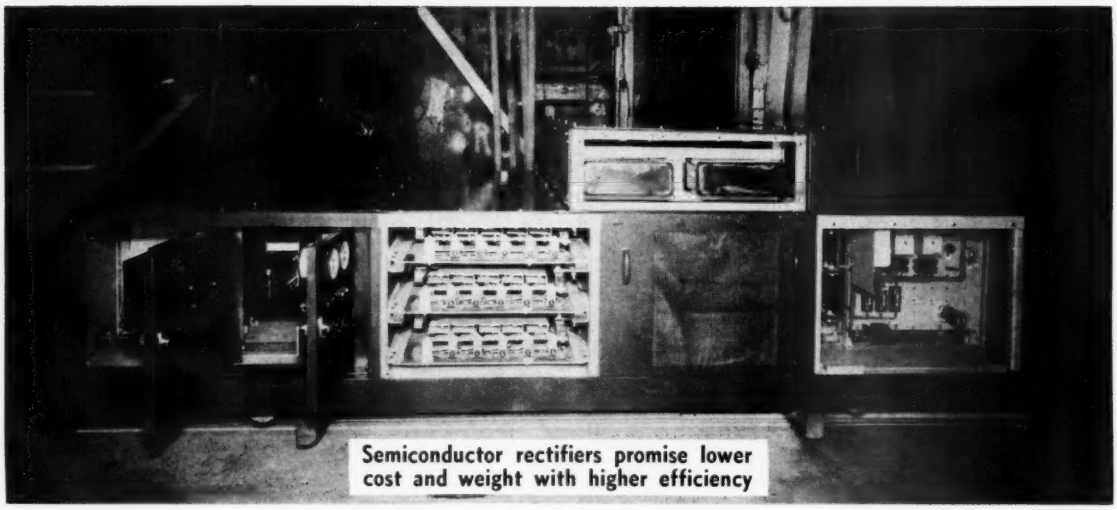
Sinking Costs Ennumerated

Since the company had almost no sinking equipment on hand, there was a fairly large capital outlay for such items as the cross-head, mucker, shaft forms and many other smaller items. Based on a 500 ft shaft this equipment

(*continued on page 64*)



The safety crosshead is unique in that the hoisting cable is off-set one ft from a vertical plane through the shaft guides in order to let the bucket and crosshead clear the mucker as pictured



Semiconductor rectifiers promise lower cost and weight with higher efficiency

Silicon Rectifiers for Mining Service

By RALPH EDWARD WAHL
Senior Design Engineer
D-C Equipment
Low Voltage Switchgear Dept.
General Electric Co.

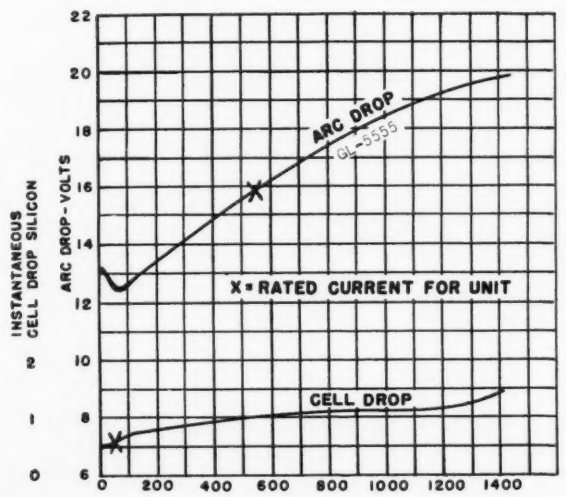


Fig. 1. Load current in peak amperes per tube or cell

MINING operations require relatively large amounts of d-c power. This power has been provided by mercury-arc rectifier units for the past 20 years.



Today, the many advantages that silicon rectifiers offer over mercury arc are allowing them to "take over" in the mines. The 30 percent lower cost and weight of semiconductor rectifier units with equivalent reliability are the primary reasons for this. Higher efficiency also makes them more desirable for new installations.

Comparison of Mercury-Arc Tubes with Silicon Power Cells

Figure 1 shows that the forward voltage drop of a silicon power diode is only one volt compared to 15 for a mercury-arc tube. In actual practice,

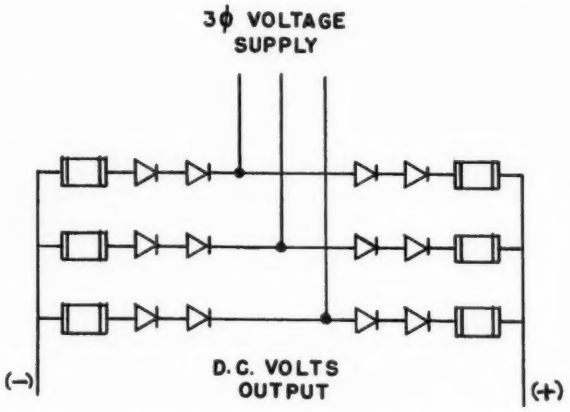


Fig. 2. Three-phase bridge rectifier (ASA C34.1 No. 23)

a full wave bridge (figure 2) containing two series cells is being used. This gives four times the voltage drop of one diode, or four volts. This is about 25 percent of the arc drop of mercury arc, and thus approximately 25 percent of the power loss. These lower power losses raise the efficiency approximately two percent. In the future, when silicon power cells are manufactured with higher inverse voltage rating, one series cell can be used, further increasing efficiency.

Silicon power cells may be cooled by forced air and thus the water-to-air or water-to-water heat exchangers with associated controls are not required.

Inverse characteristics of mercury-arc tubes are excellent and far in excess of requirements for mining service. Silicon cells at present have inverse ratings in excess of 600 with expected ratings of 1000 in the near future. Surge voltages generated by intermittent operation of load devices, motors, etc., are severe. However, sufficiently high inverse voltage rating (provided by two cells in series) with surge voltage protection provides adequate margins of safety.

Arc-Backs Versus Shorted Cells

When mercury-arc tubes are overloaded, they arc back, i.e., fail to block inverse voltage, until power is removed and they recover. The power circuit breaker removes power to permit this recovery. Overloaded silicon cells short in the inverse direction and must be removed from operation by power isolating fuses in series with these cells.

Short Circuits

D–C faults occur rather frequently in mining service, and the unit must be protected against these. Special d-c contactors (72) with d-c overcurrent relay (76) remove load when a fault occurs. Load indicating resistor with master relay (4) enables relaying to close d-c contactor automatically if fault is corrected.

Protection Against Arc Backs

While d-c fault protection is identical for both semiconductor and mercury arc, a-c protection is different. In semiconductor units, the a-c circuit breaker has been replaced by a fused air-interrupter switch. This is possible because silicon cells do not arc back, but fail shorted and the power isolating fuse disconnects them from the circuit. Thus, with properly installed and coordinated lightning arrestor, unit will not be disconnected from power supply by lightning. Local mining codes in some states do not permit use of fused air interrupters underground. In this case an a-c breaker can be used.

External Fault Protection

Internal faults, of course, will operate fuses in fused interrupter switch. With a supply circuit breaker, it is necessary to have extensive relaying to distinguish between lightning faults (or other external faults than d-c) and internal faults.

Performance Characteristics

Figures 3, 4 and 5 show efficiency and power factor comparisons for 300-kw mercury-arc and silicon power rectifier cars. Regulation of silicon car from no load to full load with constant a-c input voltage applied to transformer primary is approximately seven percent. For the same conditions with mercury arc, regulation is also seven percent.

Regulation principles for mercury-arc units have been covered in other papers.

Silicon rectifier cells capable of phase control are under development, but are not available to this date. Therefore, means external to the cells must be used to provide voltage regulation of output power. Many means are available to accomplish this, but a three-phase partial-range power amplistat has the most advantages—high efficiency, power factor, and speed of response with minimum size and weight.

Figure 6 shows an elementary diagram of an amplistat which consists of six silicon steel cores each with gate (power winding), control and bias windings.

Figure 7 shows equivalent d-c voltage drop across a saturable reactor which is similar to that across the amplistat except a-c flows through the power windings. Control power in this basic magnetic amplifier usually runs one to two percent of output power. In an amplistat, control power

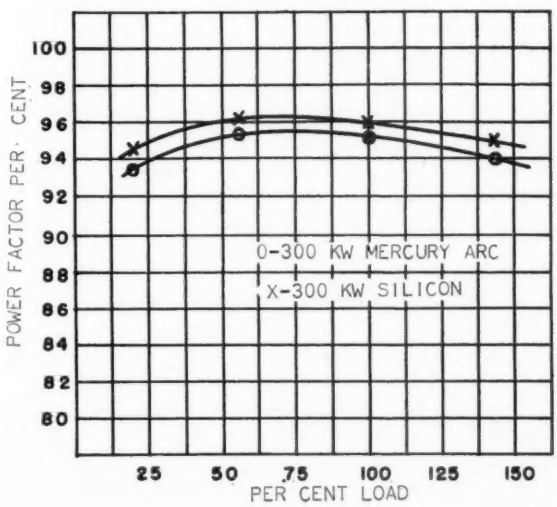


Fig. 3. Vector power factor for unregulated 300-kw mercury-arc and silicon power rectifier units for mining service

usually runs 0.001 to 0.002 percent, but to achieve high speed of response this must be increased to about 0.1 percent by a forcing resistance.

Actually an amplistat functions in a manner very similar to a thyratron or mercury-arc tube. That is, the firing angle u is controlled by the d-c current in the control winding just as the firing circuit does, except that the firing circuit uses pulses of d-c voltage. In each case, however, the initial portion of the supply voltage is absorbed by the device, amplistat or tube; while after firing occurs, the supply voltage appears across the load. A tube has full voltage range of control inherently, but an amplistat can be made partial range by design. This partial range is achieved by using less magnetic core material and winding than is required to hold off the entire voltage of the supply. If one-half voltage control is desired, approximately one-half magnetic core material and copper winding is required. If 25 percent voltage control is desired, then approximately 25 percent material is required in the amplistat.

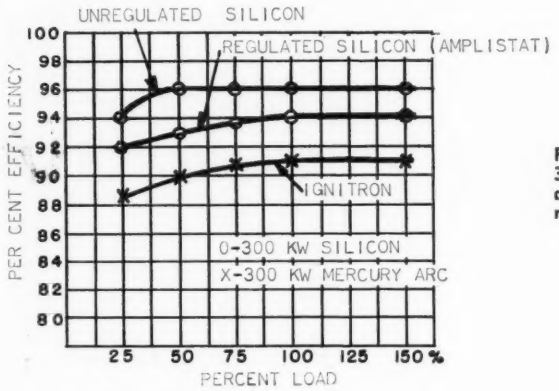


Fig. 4. Efficiency of 300-kw mercury-arc and silicon power rectifier units for mining service

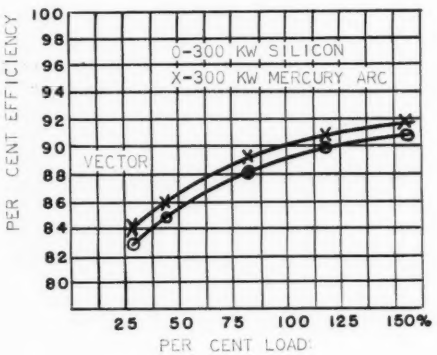


Fig. 5. Power factor for regulated 300-kw mercury-arc and silicon power rectifier units for mining service

Change in firing angle is shown in figure 9 for increasing numbers of control ampere turns. Figure 9B is for low control ampere turns with near maximum voltage absorbed by the amplistat, while 9E is for maximum control ampere turns with minimum voltage absorbed by the amplistat and maximum voltage to the load. Figure 9A shows the manner in which flux changes for these four conditions.

This ability to absorb different amounts of voltage enables the amplistat to maintain a constant average d-c voltage output. With the a-c supply line at its lowest value, the amplistat is designed to produce rated output voltage. Under this condition, the amplistat is absorbing minimum voltage. Therefore, supply voltage must overcome all reactance and resistance drops and still produce rated output voltage. Reactance voltage drops include: supply line, transformer, amplistat, and bus reactances. Resistance voltage drops include: cells, fuses, and copper losses. When the supply line voltage is greater than minimum or the load is less than rated, the amplistat will be called upon to absorb some voltage to maintain rated VDC output.

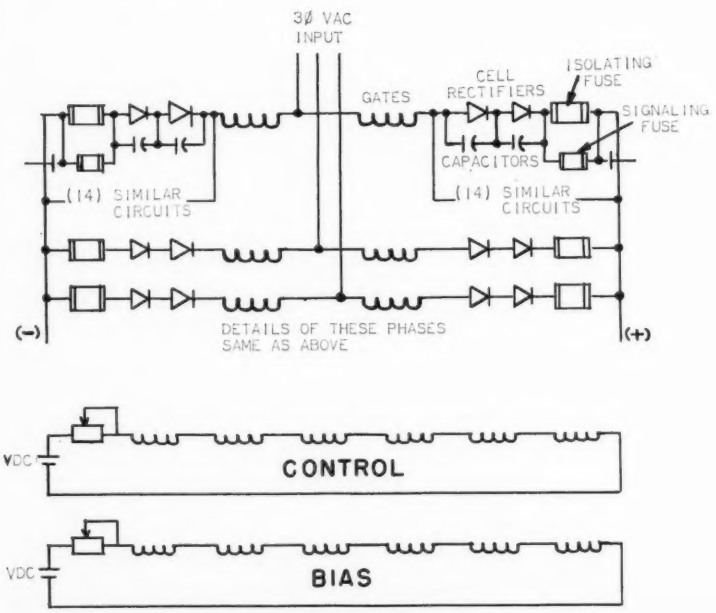


Fig. 6. Three-phase bridge amplistat

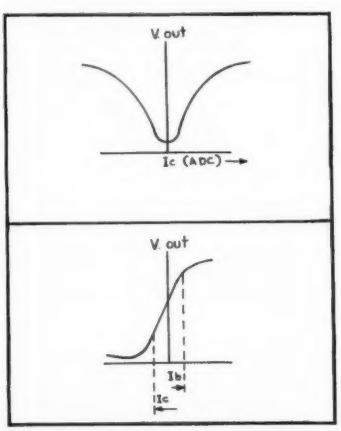


Fig. 7. (top) Saturable reactor characteristic. Fig. 8. (bottom) Amplistat characteristic

The block diagram for the complete circuit is shown in figure 10. A–C power comes into the a-c switchgear, is transformed to proper a-c voltage and then rectified and controlled in the power amplistat to regulate d-c voltage output. This d-c voltage is compared with a stabilized reference voltage, and the difference voltage causes a current to flow in the control winding in the 3 Ø power amplistat. Control currents are polarized so that if d-c output voltage is high, power amplistat will be required to absorb more voltage; while, if it is too low, power amplistat will reduce its voltage drop, thus maintaining constant d-c output voltage.

An unregulated silicon rectifier unit's components are shown in figure 11 as a one-line diagram.

Design

Figure 12 shows coordination between primary fuses, isolating rectifier fuses, silicon power cells and line contactor with its associated relaying. Reactance of the line, transformer, and amplistat limit cell current to a maximum of 900 amps peak so that cells will not fail before d-c contactor can operate. Curve A, figure 12, shows proper maximum d-c fault current while curve adjacent to A shows allowable fault current which blows supply fuses. Interrupter fuses are provided to remove a-c power in case of internal fault, while isolating fuses remove defective silicon cells from circuit. Rectifier cells are selected and coordinated so that an isolating fuse may blow in each of six phases, and the fuse monitor will continue to give a warning indication. Under this condition, the rectifier will continue to operate without loss of its continuous, overload, or short-circuit capacity. If a second fuse blows in any one phase, fuse monitor opens d-c contactor and an indicating light lets the operator know why rectifier has shut down.

Cooling

A compact, light-weight, sealed-dry rectifier transformer and a fused air interrupter switch are the main components of the transformer car. The transformer is cooled and insulated by sulfur hexafluoride which reduces its weight by nearly 50 percent under that of a conventionally liquid-filled transformer. The gas insulant is blown over the core and coils and then upward and back through a duct in the cover. Another fan draws air through a similar duct parallel to the first and cools the gas insulant. Sul-

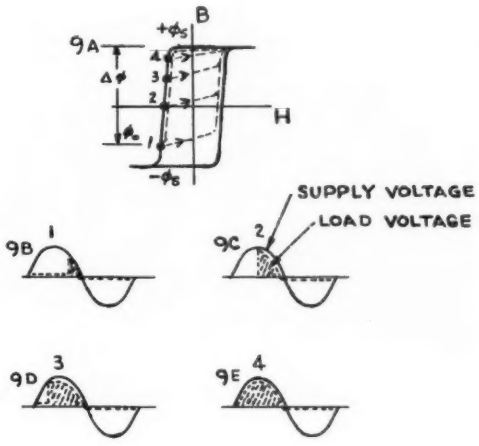


Fig. 9. Theory of operation of amplistat

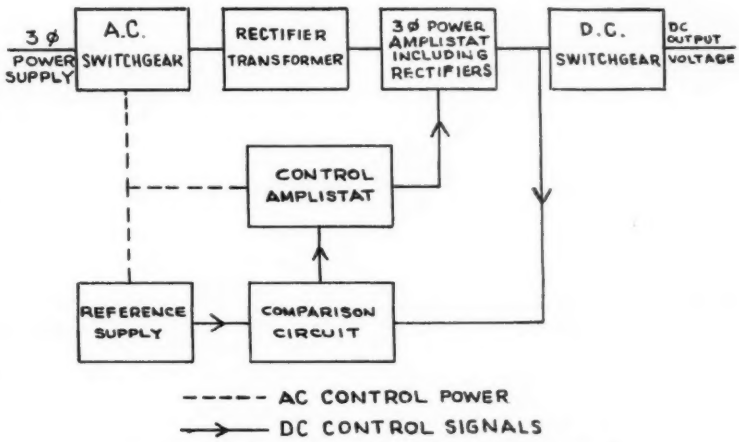


Fig. 10. Block diagram for regulated silicon rectifier mine unit

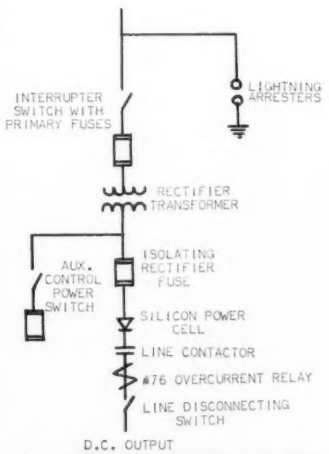


Fig. 11. Unregulated silicon rectifier unit's components shown as a one-line diagram

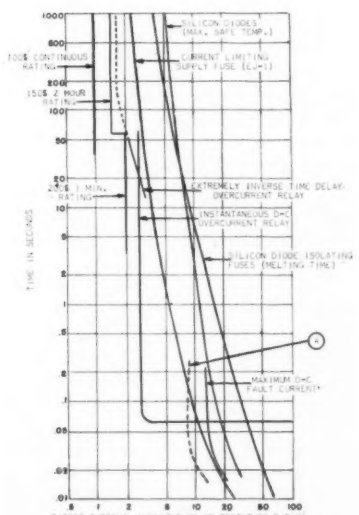
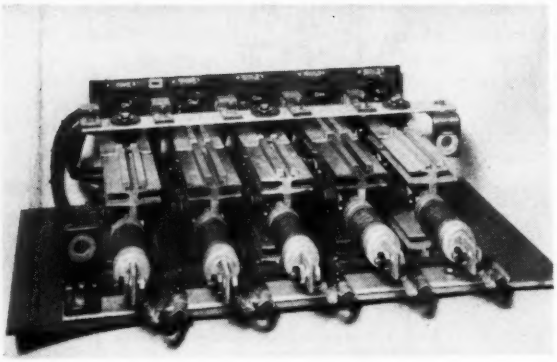


Fig. 12. Time-current characteristics of mining-type silicon rectifier units



Silicon cells are mounted on extruded aluminum heat sinks which in turn are placed in assemblies called trays

phur hexafluoride is non-flammable, non-explosive, non-toxic and has arc quenching characteristics. Liquid-filled transformers can be supplied when required.

The silicon rectifier car is divided into compartments which contain the silicon cells, cell isolating fuses, fuse failure indicating lights, power amplistat with its controls (when dry type amplistat is used) and cooling fans. An additional compartment contains d-c contactor, disconnect switch, automatic reclosing and control functions. The cooling fans blow high turbulent air over silicon cells and amplistat to cool them. Filters are not used because they cause complete or partial blocking of air. Complete blocking results in automatic shutdown. Partial blocking reduces cooling with subsequent overheating and cell failures. Design of cell heat sinks with their proper location and turbulent air flow prevents any serious buildup of dust in the unit.

Tray Design and Number of Cells

Silicon cells are mounted on extruded aluminum heat sinks which in turn are grouped in assemblies called trays.

The number of cells in a unit is determined by the voltage and kw rating. In a 500-kw car, cells are arranged in 6-2-15 three phase bridge. This means six d-c output legs each with two series cells per leg and 15 parallel paths per leg. Two series cells are used for 250 to 300 VDC because of inverse voltage requirements due to voltage surges in mine operation. Each series path of two cells has a cell isolating fuse and a fuse failure indicating light and fuse.

Amplistats

Two types of amplistats are available: dry type, which is mounted in the silicon car, and the liquid cooled, which is mounted with the transformer in the transformer car. Economics and customer preference determine which he will select.

Installation

Installation is simple; both cars can be lifted by bumpers at either end and lowered vertically down a mine shaft. Electrical connections are made by bringing three a-c leads to the interrupter switch on transformer car, connecting leads between transformer car and rectifier car, and making two connections for d-c output power.

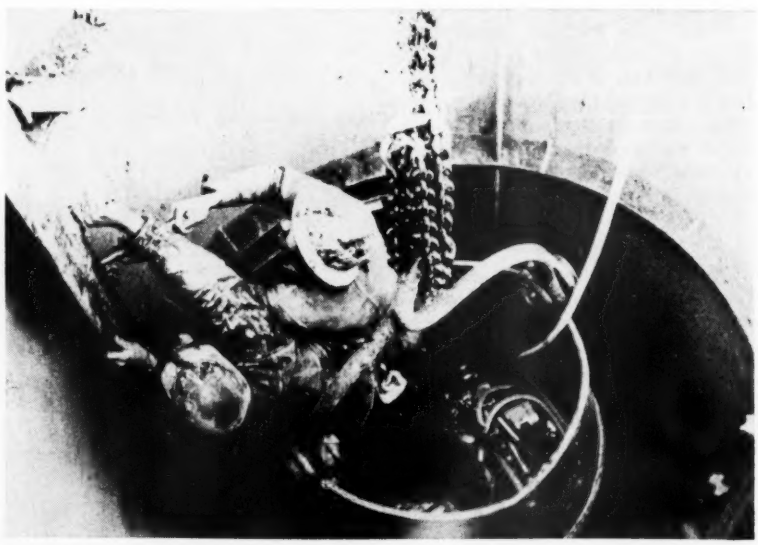
Complete coordination of all component parts produces mine car power supplies which can be relied upon in the severe duty imposed in mine service. Years of experience in design, manufacture and operation of these cars is necessary to assure this reliability.

SINKING A SMALL CONCRETE-LINED SHAFT IN WYOMING

(*continued from page 59*)

came to $34.36 per ft. Equipment rental accounts for another $11.58 per ft. Based on the first 300 ft of shaft, all materials, royalties, power, etc., but not including labor, came to $48.91 per ft. Labor will probably average around $52.00 per ft. This would give a total of $146.85 per ft. It should be pointed out that these figures do not include any of the pre-sinking expenses mentioned earlier or the pumping expense.

While the rate of advance has been unimpressive, the writer feels that with more experience a daily rate of advance of 10 to 15 ft can be accomplished. Costwise, charges could perhaps be lowered to around $110.00 per ft and even lower if all capital equipment were to be written off. As far as this size and type of shaft is concerned, the author believes it will receive wider application as time goes on, particularly in the shallower shaft category.



Blocking shaft forms. Forms are made up in two main sections, each a half cylinder, 20 ft long



will be host to 1960 MINING SHOW

Las Vegas prepares for another outstanding convention and exposition for the nation's metal miners and industrial minerals producers

OCTOBER 10 to 13 are the dates of the American Mining Congress' 1960 Mining Show, to be held at the Convention Center in Las Vegas, Nevada. John C. Kinnear, Jr., general manager of Nevada Mines Division, Kennecott Copper Corp., is the Chairman of the Western Division and has taken active charge of General Arrangements. Plans are rapidly taking shape and the meeting shows promise of being one of the finest of all time.

The Program Committee under Oscar A. Glaeser, vice president and general manager, western operations, U. S. Smelting Refining and Mining Co., is in the midst of lining up suggestions of papers for the convention sessions. In this regard, the committee will appreciate hearing from all mining men interested in the program. Their suggestions should be sent to the American Mining Congress, Ring Building, Washington 6, D. C. All proposed subjects will receive careful consideration when the State Chairmen of the committee meets in Las Vegas next month.

Included in the final program will be subjects of wide interest and speakers who will be prepared to answer the questions uppermost in the minds of mining men everywhere. The program will undoubtedly include timely discussions of National Mineral Policies, Tariffs, Taxation, Public Land Laws, Labor Relations and other matters of national importance, as they affect mining. On the operating side, it will include open pit and underground mining techniques, milling and beneficiation, safety, management problems and other topics of interest to the industry.

The exposition, sponsored by the AMC Manufacturers' Division under the chairmanship of Albert E. Seep, president of Mine & Smelter Supply Co., will be another outstanding display of mining machinery and supplies. This years' show will be the largest to date. Its educational value —in giving metal miners and industrial minerals producers the opportunity to study, at first hand, the latest in mining equipment—will be unsurpassed. Short of spending months of valuable time and thousands of dollars in travel expense, there is no other way to see, inspect, compare and discuss the many advanced and money-saving innovations offered by the vital manufacturing branch of the mining industry. The exposition is a true educational forum for keeping mining men "in the know" as to the safest, most efficient, and most economical aids for conserving our nation's mineral resources and at the same time supplying the necessary raw materials for its industries.

Nor will entertainment be lacking at the 1960 Mining Show. How could it at Las Vegas—where sightseeing opportunities abound—where restful outdoor patios with swimming and lounging areas are always at hand—and where modern resort hotels feature top-notch floor shows? In view of the wealth of entertainment available, no official AMC evening functions will be held. For the convenience of Mining Show visitors, a central bureau will be set up at which reservations may be made for the dinner and midnight shows at all the leading hotels.

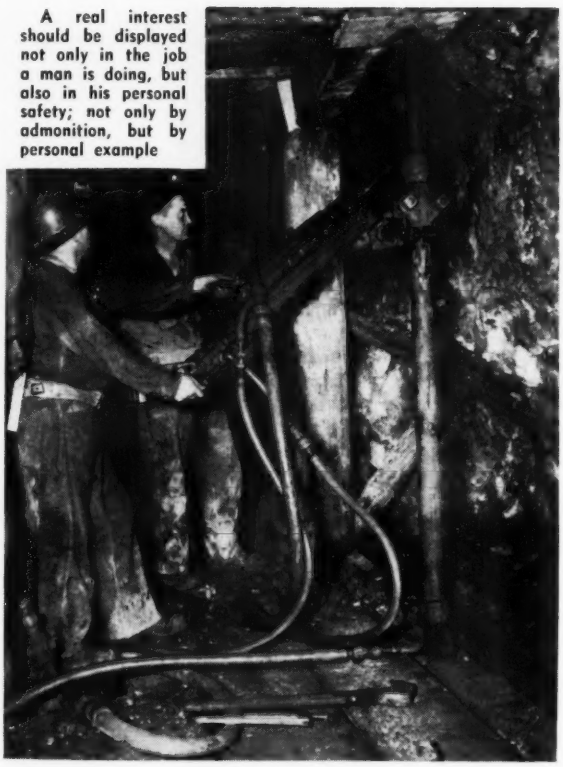
A large number of miners' ladies will be coming to Las Vegas too, and a special program is being arranged for them. A fashion show and luncheon is planned for Tuesday noon—to be held at both the Riviera and New Frontier Hotels, to take care of the crowd. And on Wednesday, the ladies will enjoy a tea and reception at the beautiful Las Vegas home of Mr. and Mrs. J. W. Wells.

Two outstanding trips have been arranged for Friday, October 14, to visit some of Nevada's interesting mining operations. One group will fly to Ely to inspect Kennecott's open pit operations at Ruth, followed by a tour of the company's reduction plant at McGill to inspect the milling and smelting operations which produce blister copper.

The other group will see the plant and quarry of U. S. Lime Products Division at Apex, and some of the plants of Basic Management, Inc., at Henderson. After a short drive to Blue Diamond for lunch, they will visit the open pit gypsum operations, plaster mill and wallboard plant of the Blue Diamond Co. division of Flintkote Co.

Reservations for hotel accommodations should be submitted promptly. If you have misplaced the form for this purpose, the AMC office will be glad to supply another. Although the many fine hotels along the "strip" should be able to accommodate all comers, it would be unwise to delay further. Reservations are being handled by the AMC Housing Bureau, Convention Center, Paradise Road, Las Vegas, Nevada.

Viewpoints on Safety



A real interest should be displayed not only in the job a man is doing, but also in his personal safety; not only by admonition, but by personal example

Part I—Getting Proper Attitude to the Working Face *

Safe practices are a product of supervisory alertness that prevents employes from becoming lax in their attitude toward safety

By DONALD E. WILSON
Division Mine Foreman
The Bunker Hill Co.

THE proper safety attitude at the working face is just as necessary and important as having the proper tools and equipment. When the wrong tools and equipment are used, the job is not being done either safely or efficiently. The same is true with the wrong attitude. The very best of tools—the very best of equipment—can be put to naught when used by a man who is unhappy, careless or confused.



Employe Influenced Thru Contacts

In addition to assuring that proper tools and equipment are available, provision must be made for the repair and servicing of tools and equipment if the operation is to run smoothly. Just as arrangements for proper tools and equipment for the job are made outside the mine so must arrangements for proper attitude be made before the man ever gets to the job. The initial employment interview and the pre-employment physical examination are the first opportunities to influence the proper attitude.

Now, in these first two steps a man is treated as an individual—this is important. In the first place, he is getting the idea that Bunker Hill is interested in him. Secondly, he's going to be more willing to listen when he is oriented on the job.

Usually people will follow the example set for them. If you smile—they smile back. If they're growled at—they growl back. Just as the moon reflects to earth the light of the sun, so will people normally reflect back to you the expression you show them. If they are made to feel that an interest is shown in them as an individual, they will normally reflect that interest back and attempt to show an interest in those things that make your contacts with each other pleasant and productive.

An attempt is made to build up a

* First of a series of six articles in which the views of labor supervision, and top management are expressed

new man's interest by briefing him on elementary safety rules and precautions. His first job is with an older, experienced man who can show him not only the proper way to do the job, but can also help him find the *right* answers to questions that always perplex the new man.

It was "Boss" Kettering, of General Motors, who one time said it was too bad we didn't treat our employes the same way we treat our machinery. We don't attempt to run equipment without first trying to understand something about how it should be operated. We need to try to understand those men who work for us—their hopes, their fears, their frustrations. We never attempt to run equipment without checking it to be sure it's in running condition; and we're always prepared to do some maintenance on it. A supervisor must have this same willingness to check on his employes and help them maintain a proper attitude toward both their job and their personal safety.

Our first attempt to understand a man comes at the employment office, then at a physical examination and an initial interview. These are followed up with the break-in period with an "old hand." The checking and maintenance takes place every time contact is made with the man.

Supervisors Guide All Work Habits

Whenever the writer goes into a man's area, he checks to be sure the man has the tools and equipment needed to do the job the way it should be done—a check is made to be sure that the man knows how to properly use and maintain the equipment he is using.

Another maintenance check covers the safety of the work place. A scaling bar is taken and a check made to be sure there are no loose rocks or slabs —it's remarkable how often this will prevent a "close call" for someone. A check should also be made for signs of poor housekeeping—nails not bent over, bars, picks, shovels, hose and small tools not properly picked up.

This checking isn't reserved for the "new" man only. Familiarity with the method, the equipment and the inherent dangers of the job often breeds contempt and carelessness that is the forerunner of a serious accident or of unnecessarily wasteful practices. This is the time to let a man know how he's handling his job. If he does not seem to be doing his best, show him how he can improve. If he's doing good, tell him so and tell him to keep up the good work.

Try to always display a real interest not only in the job a man is doing, but also in his personal safety—not only in attitude toward him but also by personal example. It costs very little production to stop and talk to a man—even if it's only about his family or his favorite hobby. Frequently, you'll find these men are sold not only on "outside" interests but also on their job, and they can often tell you how jobs can be done easier, quicker, more economically and with greater safety. When this happens *listen*, because the man's lost production is going to pay a dividend in greater efficiency on more jobs than just his own.



Familiarity with the method, equipment and the inherent dangers of the job often breeds contempt and carelessness—forerunners of serious accidents and wasteful practices

Promote Safe Practices by Example and Admonition

When a drill bit, an axe or a pick gets dull, it is sent to the steel shop for sharpening. We can't sharpen our men on an emery wheel; but we can by example and admonition keep them from becoming dull on safety practices and from getting an "I don't care" attitude.

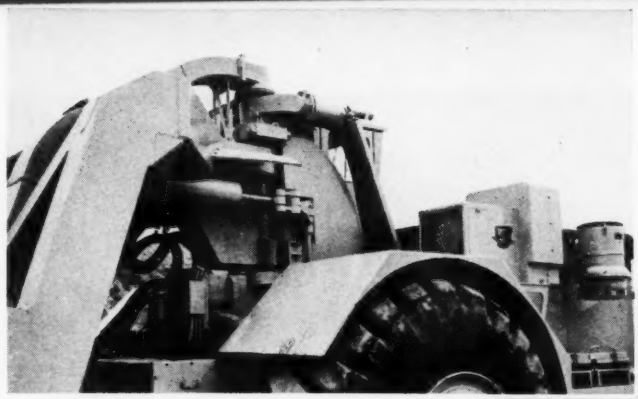
Perhaps one of the best ways we have of sharpening dull safety habits among our men is the hulla-baloo raised when there is an accident. The injured man's partner, his shifter, the assistant mine foreman and the writer all go over the details with a fine tooth comb. These accident investigations can be pretty cold business, because it's like locking the stable after the horse is gone. However, it leaves no doubt in the employes' minds as to the company's interest in accident prevention. This is one time that the supervisors have a real opportunity to demonstrate just as much interest in their employe's safety record as they display in his production record.

Men are of much greater value than equipment—equipment can be replaced—a life cannot. Our men deserve as much care and attention as our machines.

We lubricate machines with petroleum products to keep them running smoothly. We have to lubricate our people with a display of real interest in them if we expect them to run smoothly.

When equipment isn't operating properly it has to have some kind of maintenance or we have what is called a breakdown. Preventive maintenance is the answer to most equipment breakdown. When we have low production, too many accidents and low morale, there is another kind of breakdown called "poor attitude." The employe's breakdown, like the equipment breakdown, can be prevented by proper maintenance.

The supervisor who sees that his machinery is properly checked and maintained has a minimum of equipment breakdowns. The supervisor who by good example in word and deed promotes a wholesome attitude in his men will find he doesn't have personnel breakdowns—he'll have both proper equipment and proper safety attitude at the working face.



A kingpin hitch (left) between the two-wheel tractor and the two-wheel trailer allows independent oscillation of tractor and trailer, providing unusual maneuverability. The off-highway vehicle (below) is powered by a 600-hp diesel engine which generates current for electric motors mounted in the rim of each wheel



Diesel-Electric Truck

A giant rear dump ore hauler illustrates potential of the electric wheel drive

A NEW 55-ton pay load diesel-electric truck was demonstrated recently at a stone quarry near Tulsa, Okla. Designed for open pit mining and for large scale construction operations, the rear dump ore hauler, called the Lectra Haul, showed remarkable maneuverability and versatility in turning, climbing, starting, stopping, and dumping.

Manufactured by Unit Rig & Equipment Co., the truck is 41 ft 8 in. long, 14 ft wide, and 14 ft 4 in. high. Wheelbase is 21 ft 5 in. Approximate weight distribution is as follows:

	Net Vehicle	Gross Vehicle 55-ton Payload
Front axle	77,000 lb	106,000 lb
Rear axle	34,000 lb	115,000 lb
Total	111,000 lb	221,000 lb

The off-highway vehicle incorporates General Electric's motorized wheel drive. Electric power for the motorized wheels is supplied from a generator driven by a 600-hp Cummins VT-12 diesel engine. Each wheel has its own integral electric motor and simple gear drive arrangement. The entire motor is mounted within the rim, which in turn is bolted to the side of the vehicle. The four series-wound traction motors are continuously cooled by external blowers.

In addition to generating current for the electric motors, the diesel engine also drives the excitation generator, battery charging generator, air compressor, hydraulic pumps, and front wheel ventilation blowers.

To cut haul length and reduce road maintenance expense, the truck is designed to take grades up to 15 percent fully loaded. Gradability, based on 60 lb per ton rolling resistance, is given below:

Grade (%)	Speed (mph)
15	4.4
12	5.3
9	6.6
6	8.6
3	13.5
0	23.5

Dumping is accomplished through a pair of three-stage cylinders.

Through use of a kingpin hitch between the two-wheel tractor and the two-wheel trailer, independent oscillation of tractor and trailer provides a high degree of maneuverability when turning in restricted areas. Positive hydraulic power steering permits a maximum turning angle of 60°, left and right. According to the manufacturer, a 50-ft wide highway is sufficient for the truck to make a full 180° turn.

Dynamic braking on all four wheels utilizes wheel motors as generators and dissipates vehicle kinetic energy into air cooled resistors. No friction brakes are required for downgrade operation. Parking and emergency brakes employ hydraulic aircraft disc types on all four wheels.

Rear dump specifications list capacity as 36 yds struck, 42 yds heaped (3:1). Bowl measures 21 ft long, 13 ft wide and 7 ft deep. Loading height, with standard tires, is 11 ft 8 in.

The vehicle has a conventional arrangement of steering wheel, foot throttle, brake pedal and other controls.



Over a third of fatal roof fall accidents occurred because an existing roof support plan was not followed

THE ADOPTION of roof bolting and systematic timbering plans has been a big step toward eliminating errors in judgment in supporting roof. These plans have eliminated mistakes such as not setting safety posts when they should have been set, putting support in the wrong place, and not setting support close enough. Fortunately, the logic of systematic support for reducing roof fall accidents has spread rapidly throughout the coal mining industry.

For a roof support plan to be effective in preventing roof falls, and thus effective in preventing injuries, two factors must be present:

1. **The plan must be adequate to meet the normal roof support requirements of the particular mine for which it was designed, with a further requirement for additional support when conditions necessitate it.**
2. **The plan must be followed in all cases without exception.**

Information gathered by Federal and State agencies, and the National Safety Council, shows that 34 percent of fatal roof fall accidents occurred because the company's own roof support plan was not followed. This means that in a large number of cases men have lost their lives because *known* safety measures were neglected. It certainly is tragic enough to have accidents from unforeseen or "unavoidable" causes, but it is folly of the worst kind for men to lose their lives because of failure to do what we know *must* be done to prevent accidents!

As we have noted, State and Federal inspectors have often found mines violating their own roof support plans. The occurrence of a fatality caused many such mines to closely follow their support plans again. However, sad to relate, after a period of time, many of these same mines went back to their lax habits and further fatalities resulted.

It is difficult to understand why a workman should have to be closely supervised in matters regarding the protection of his own life. But supervision has been found to be *necessary!* The fact that all of our states have found it necessary to employ highway patrolmen to enforce highway safety regulations, for instance, indicates that very few of us are as cautious as we should be to protect our lives, even on the highways.

It is a human trait to follow the line of least resistance and use less than the required support. This makes it *necessary* that the foreman not only give instructions to his men as to safe roof support procedure, but that he follow up to make sure his instructions are carried out.

The frightening death and injury toll cited previously is certainly convincing proof of the need for closer observation of systematic roof support plans in every coal mine. Adherence to a timbering plan is the *best* way to prevent injuries and deaths and to save money, too. The plan should be the No. 1 safety measure on a boss's list. Bosses in mines participating in the "National Campaign to Prevent Injuries from Roof Falls" have got to tighten up on the observance of procedures for supporting the roof if they are to meet the campaign goal—to cut roof fall accidents by one-half in the next year!

In mines using roof bolts, men will continue to be injured because of failure to set roof jackets or safety posts in by the last row of roof bolts, unless management sees to it that such support is set.

In mines using conventional timbering methods, men will continue to be injured if permanent roof support is not kept within the required distance from the face; if safety posts are not set in by the last permanent timbering; if safety posts are not reset promptly after being displaced by machinery, blasting, or for other reasons; and unless individual foremen require that roof support standards are followed *without exception!*

The steering committee of the "National Campaign to Prevent Injuries from Roof Falls" is urging each coal mine to take immediate steps to put a stop to these recurring major causes of accidents by:

1. **Making sure that everyone knows the timbering system.**
2. **Making sure that everyone realizes the necessity for observing it strictly.**
3. **Making sure that everyone observes it exactly in *each* section of the mine.**

** Prepared by the Advisory Committee 1960 National Campaign to Prevent Injuries from Roof Falls in Coal Mines.*

CANCER'S DANGER SIGNALS CAN BE SAFETY SIGNALS

You can do two things to guard yourself against cancer: Have an annual health checkup. Alert yourself to the seven danger signals that could mean cancer: 1. Unusual bleeding or discharge. 2. A lump or thickening in the breast or elsewhere. 3. A sore that does not heal. 4. Change in bowel or bladder habits. 5. Hoarseness or cough. 6. Indigestion or difficulty in swallowing. 7. Change in a wart or mole. If your signal lasts longer than two weeks, go to your physician. Give him the chance to give you the chance of a lifetime.

AMERICAN CANCER SOCIETY ®

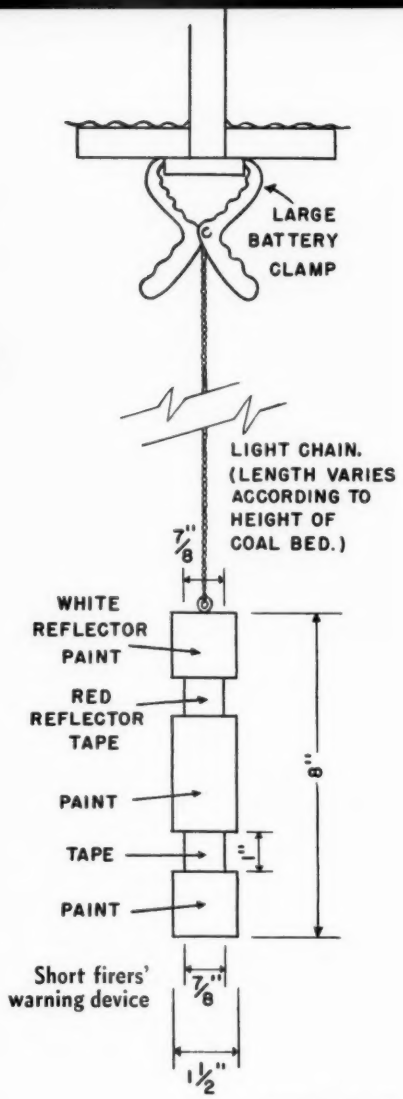
Operators' Corner

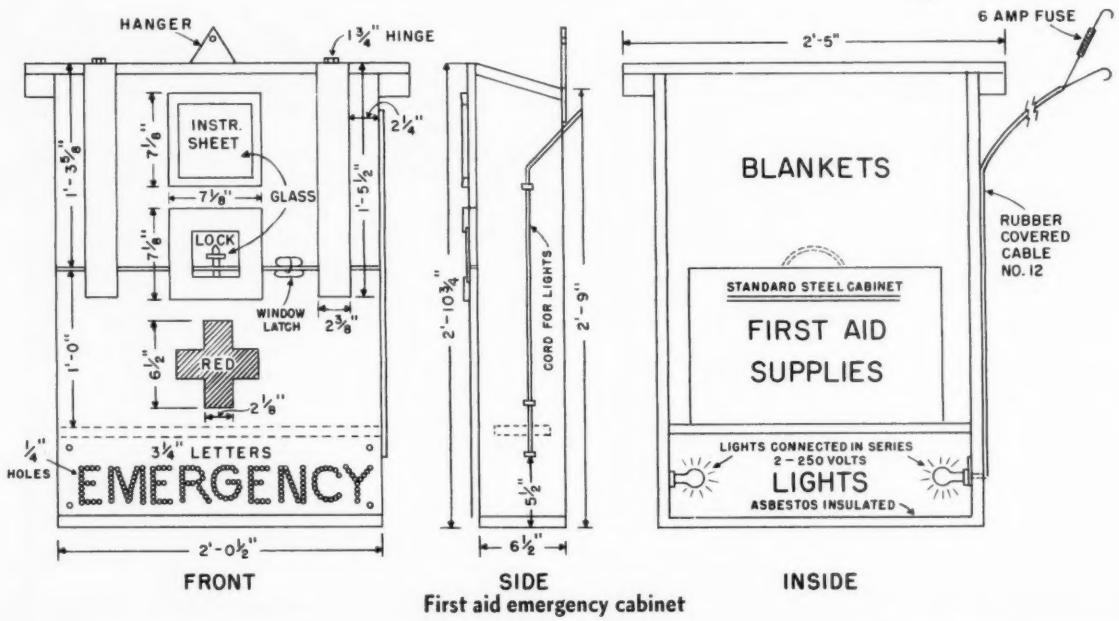
Two Ideas From The Midwest

E. E. Quenon, safety director for Peabody Coal Co., is responsible for the two ideas presented in this month's Operator's Corner.

One, a shot firers' warning device, was designed when Mr. Quenon saw miners pass conventional "Danger Boards." Sometimes these are difficult to see and are easily overlooked. The solution was an eight-in. wooden spool, coated with reflecting paint, which could be hung from a roof bolt or timber. Three of these across an entry make it impossible for a man to pass them by without notice. A large battery clamp facilitates putting up and taking down.

The second innovation is a locked First Aid Emergency Cabinet that can be easily opened. A glass window has to be broken before the cabinet can be opened, deterring unauthorized use of the materials contained in the cabinet. Two light bulbs in the bottom keep the cabinet dry in addition to lighting up an emergency sign. Constructed of wood, the cabinet is hung on a mine post at a central location on the section.





First aid emergency cabinet



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WHAT'S WRONG WITH THIS PICTURE?

Something backwards, maybe?
Sure, the dragline. It's working from the spoil pile, not the highwall.

Maybe it seems backwards, but there's nothing backward about this operator who is uncovering 30% more coal in a given period of time than he was with conventional methods. And he's cut bulldozer reclamation time, and dragline maintenance costs too.

This new development is "explosives stripping". . . heavy shooting with overburden loaded to at least 1 lb. of blasting agent per cubic yard. Sure, drilling and explosives costs are higher . . . about 20%. But look what happens! Up to 40% of the muck is moved right onto the spoil pile without *any* mechanical handling. That's a lot of overburden you don't have to handle.

Breakage is better, digging easier. Digging methods are easy too. The drag works from one end of the shot at a slight angle to the highwall, cutting a keyway. Then, with a bulldozer smoothing the way, it walks right along the spoil pile dragging from the keyway. As the material is scooped off, the dragline swing becomes less and digging efficiency goes up even more.

This is a new development you can't afford to ignore, but you may have to see it to believe it. Ask your Atlas representative where you can observe this stripping practice. See if it can be adapted to your conditions.

EXPLOSIVES DIVISION
ATLAS
POWDER COMPANY
WILMINGTON 99, DELAWARE
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As Viewed by HENRY I. DWORSHAK of the American Mining Congress

GOVERNMENT silver policies are once again under attack. Four New England Senators—Green and Pastore (Dems., R.I.), Bush (Rep., Conn.) and Dodd (Dem., Conn.)—have jointly sponsored a bill to repeal the Silver Purchase Act of 1934 and subsequent silver purchase laws, coupling with its introduction a plea that the Senate Banking and Currency Committee give it immediate consideration.

Their bill is similar to measures introduced, but not acted upon, in previous years. It would repeal laws which (1) authorize Treasury acquisition of domestically mined silver at 90.5 cents per ounce; (2) permit Treasury sale, at not less than that price, of silver not required for coinage or as backing for silver certificates; and (3) require all monetized silver to be valued at $1.29 per ounce (the difference or "profit" is termed "seigniorage").

In an obvious effort to insure the availability of Treasury stocks to silver fabricators, who have endorsed the measure, it would authorize the Secretary of the Treasury "to sell or lease any silver held or owned by the United States in excess of the requirements of the Treasury, at such rates, at such times, and upon such terms and conditions as he may deem reasonable and most advantageous to the public interest." Under present law, the Secretary may make such sales, but at not less than 90.5 cents an ounce.

Domestic silver producers are expected to vigorously oppose, as in past years, enactment of this legislation. They have pointed out that for many years free-world consumption of silver has exceeded production by a substantial margin; in the United States, in particular, the Treasury is consuming each year in coinage more silver than is produced annually in this country.

Government figures show that at the end of 1959, the Treasury held approximately 1,850 million ounces of silver, including 1,676 million held as a reserve against outstanding silver certificates. The remaining 174 million ounces of "free" silver may be used for coinage or, at the discretion of the Secretary, may be sold to industry.

The Treasury obtains its "free" silver principally through seigniorage—the 30 percent profit the Government takes on silver purchased from domestic producers. Additional supplies come from past purchases of foreign silver, plus minor amounts derived from gold bullion, from the melting down of obsolete coins, and from sweepings. In the past two decades the supply of "free" silver has declined by more than 80 percent from a peak of 1.25 billion ounces.

In view of the small and steadily diminishing supply of unobligated silver, it is argued by many that the Treasury should halt Government sales altogether and allow the metal to find its own price level on domestic markets. They point out that an effective ceiling would remain, since at any time that the price rose above $1.29 per ounce, at which rate silver is monetized, holders of silver certificates would redeem them.

The Senate Banking and Currency Committee has not indicated whether any action on the Green bill is planned.

★ ★ ★ ★ ★ ★

Washington Highlights

SILVER: Repeal of purchase laws urged

RESIDUAL OIL: Import quotas hiked

UNIONS: Bill would broaden monopoly power

LEAD-ZINC: Import tax measures introduced

WILDERNESS BILL: To get further consideration

MULTIPLE-USE: Forests measure moves in House

★ ★ ★ ★ ★ ★

GOVERNMENT PERMITS HIKE IN RESIDUAL OIL IMPORTS

Despite an Interior Department announcement only a short time before that it had "no information which would appear to warrant an upward adjustment of permissible residual oil imports," Secretary Seaton last month approved a 12-million-barrel increase in the quota for the six-month period ending June 30.

His action was immediately criticized by Stephen F. Dunn, president of the National Coal Association, and Joseph E. Moody, president of the National Coal Policy Conference. Pointing out that the increase is the equivalent of 3 million tons of coal, Dunn said the coal industry was "shocked and keenly disappointed that the Government would act without holding hearings and without consulting those whose interests are so vitally involved." He added: "This hasty and ill-advised move substantiates the coal industry's contention that there should be an immediate and impartial study of the Nation's total fuel requirements."

Moody asserted that the import hike represented a "surrender of the Department of the Interior to major oil importing companies" and called for a Government investigation of the marketing practices of the importers. "We believe such an investigation will disclose the diversion of large quantities of residual oil from small users solely dependent on residual to

large steam generators equipped to burn both residual oil and coal interchangeably," Moody declared.

Both had previously charged that large importers were creating artificial shortages by importing up to 70 percent of their six-month allocations in January and February and distributing the oil to new industrial customers at dump prices.

Secretary Seaton may have had these charges in mind when he announced the increase in permissible imports, for he simultaneously revealed that, effective July 1, company-by-company allocations of import quotas will be established on a quarterly rather than on a semiannual basis.

This change was greeted with approval by coal industry spokesmen. Julian D. Conover, executive vice president of the American Mining Congress, wrote Secretary Seaton that the AMC was gratified by his announcement that allocations would be placed on a quarterly basis.

"Experience during the current allocation period," Conover stated, "when residual oil importers accelerated unduly their rate of importation during the first three months and thereby forced an upward adjustment of 12 million barrels in import levels for the remainder of the period, is in our judgment clear justification for your recent announcement.

"We heartily concur that the making of allocations on a quarterly basis will facilitate consideration of normal patterns of marketing and importing and thereby help maintain the effectiveness of the control program."

COMMITTEE APPROVES BILL TO BROADEN UNION POWER

Although less than a year has passed since Congress, heeding the voice of an aroused electorate, strengthened Taft-Hartley Act provisions outlawing secondary boycotts, the House Labor Committee has approved a bill to legalize union use of this powerful weapon at any job site where the employees of more than one employer are involved in construction, alteration, painting, repair, or other work.

While not unexpected, this is an alarming development which clearly indicates the continuing influence in Congress of those unions which would benefit from the measure's enactment —primarily the Teamsters and the Building Trades.

The Labor Committee's approval was not unanimous. Among the minority on this issue was its chairman, Rep. Graham A. Barden (Dem., N.C.), who told the House last month that the evils inherent in the bill have been "smoothly glossed over" and its true implications and objectives "effectively concealed." The purpose of the measure, he pointed out, is to permit a union which has a labor dispute with one building contractor to strike and picket all other contractors and subcontractors merely because they happen to be working on the same building project and without regard for the fact that neither they nor their employees are involved in the dispute. Thus, he continued, unions would be empowered "to shut down any construction project in its entirety, including vital national defense projects, any time it suits their whim or fancy."

Barden concluded his speech with this statement: "I cannot believe that this Congress could so lightly regard its sacred trust on behalf of the American people that it would enact legislation to legalize the use of the dangerous and unjustifiable secondary boycott strike and picketing weapon by Mr. Hoffa and the other leaders of the Teamsters Union, or by any other union leaders, and thereby bestow upon them the legal power to bring chaos to our Nation's largest industry, shackle our efforts to construct vitally needed facilities for our national defense, and imperil the very safety of our Nation."

LEAD-ZINC IMPORT TAX BILLS ARE INTRODUCED

On the heels of the Tariff Commission's recent formal report to the Senate on current conditions in the lead and zinc industry, Representatives Howard Baker (Rep., Tenn.) and Gracie Pfost (Dem., Idaho) have introduced bills which—while they differ in major respects—would replace current duties on imports of lead and zinc metal, ores and concentrates with higher import taxes and place additional commensurate duties on semimanufactured articles of the two metals.

Baker's bill would, in general, set the new import taxes at levels proposed by Tariff Commissioners Schreiber and Sutton (the other four Commissioners refused to submit any recommendations in connection with the report). These rates per pound (current rates shown parenthetically) are: Lead metal, 3¢ (1-1/16¢); lead in ore and concentrates, 2.1¢ (0.75¢); zinc metal, 2.5¢ (0.7¢); zinc in ores and concentrates, 1.75¢ (0.6¢); and semimanufactured articles of either metal, various offsetting increases.

Mrs. Pfost's measure would set the import taxes at 4¢ per pound on both lead and zinc metal and at 2.8¢ per pound on either metal in ores and concentrates. Her bill would also provide that these import taxes would be inoperative with respect to either metal, on a month-by-month basis, whenever domestic prices of lead and zinc metal are at least 15½¢ or 13½¢ per pound respectively and, in addition, the combined price of the two is at least 29¢ per pound. The offsetting increases on semimanufactured articles would not be subject to suspension, however.

When he introduced his bill, Baker told the House that "there may be some in the lead-zinc industry who believe in good faith that higher rates of duty than those contained in the bill are required to solve the problems of the industry, and certainly their views will receive consideration by the Ways and Means Committee as will the views of those in the industry who believe that the proposed rates are too high."

The Committee has not announced whether it plans to hold hearings on these measures.

FURTHER CONSIDERATION SET FOR WILDERNESS BILL

Late in April Chairman Murray (Dem., Mont.) announced that the Senate Interior Committee would again consider, in closed-door sessions, the highly controversial bill to establish a National Wilderness Preservation System "for the permanent good of the whole people."

The American Mining Congress has consistently opposed legislation of this type—which would set aside many millions of acres of national forest lands for the virtually exclusive use of outdoor enthusiasts—primarily on the basis that its enactment would severely hamstring if not entirely eliminate prospecting and mining on large areas of the public domain.

The Committee will have before it many proposed amendments to soften some of the bill's objectionable features, but its proponents, under the leadership of Senator Jackson (Dem., Wash), are expected to make an all-out fight for Committee approval with few if any changes in the measure as introduced last year by 18 Senators.

FORESTS MULTIPLE-USE BILL WINS COMMITTEE APPROVAL

The House Agriculture Committee has unanimously approved legislation which would establish as a national policy that national forests shall be administered for "outdoor recreation,

(*continued on page 85*)

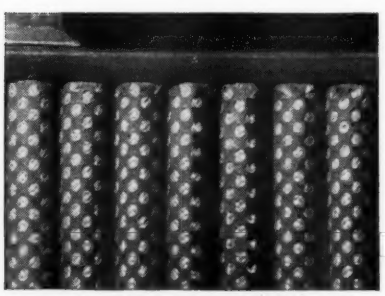
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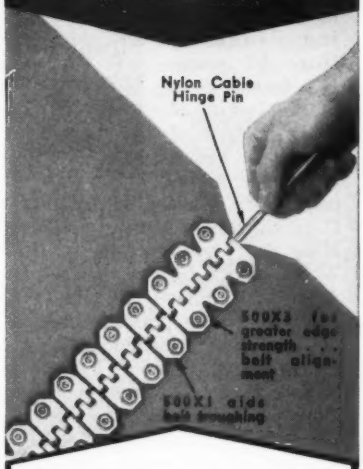
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personals

James Boyd, former vice president—exploration for Kennecott Copper Corp., has been elected president of Copper Range Co. Boyd, whose career in the mining industry spans 33 years, is a former dean of the faculty at Colorado School of Mines, assistant to the Secretary of the Interior, Director of the U. S. Bureau of Mines, and Defense Minerals Administrator. During World War II he served in the U. S. Army and attained the rank of Colonel. He was appointed director of the Bureau of Mines in 1947 and resigned that position in 1951 to join Kennecott as exploration manager. In 1955 he became vice president—exploration.



Herbert S. Richey, former executive vice president, Valley Camp Coal Co., has been elected president succeeding **Harry T. Ewig.** Ewig, who had been president for 27 years, was named to the newly created position of chairman of the board and chief executive officer. At the same time **Herbert L. Hilton** was elected a vice president.

Houston N. Clark has been named vice president — production, Potash Company of America. He succeeds **Russell G. Haworth** who recently resigned. Haworth joined the company in 1942 as a mine engineer and had by 1952 advanced to vice president—production. Clark, until his recent appointment, had been assistant to the president. The company also announced that **Dean R. Gidney** was elected vice president—sales. He succeeds **John W. Hall,** who had earlier been named president.

Joseph T. Kennedy has resigned as secretary of the Pennsylvania Department of Mines & Mineral Industries to assume an executive position under Thomas Kennedy, president of the United Mine Workers of America. He had been secretary to the new UMWA president before taking over his State post in 1955. **Lewis E. Evans,** deputy secretary, has been given an interim promotion to Kennedy's former secretarial post, pending confirmation by the State Senate.

Wallace G. Woolf, vice president of Kellogg operations, Bunker Hill Co., recently retired. He has been succeeded by **Charles E. Schwab,** who will be vice president — general manager of Kellog operations. Woolf joined Bunker Hill in 1918 as an experimental metallurgist to find a commercial method of treatment for the complex lead-zinc ores of the Coeur d'Alene mining district. His efforts resulted in production of the world's first special high-grade zinc from the company's electrolytic zinc plant in 1928. He became Bunker Hill's manager of metallurgy and was later promoted to Kellogg general manager. In 1956 he was named vice president of Kellogg operations.



W. Woolf

J. R. Simplot, president of the company bearing his name, has been elected a director of Independent Coal & Coke Co.

John C. Denton, president of Spencer Chemical Co., has been appointed chief executive officer of the company and **C. Y. Thomas** became chairman of the Board. Thomas had been vice chairman. To fill a vacancy created by the death of Kenneth L. Spencer, **Ralph L. Gray** has become a director. He is chairman of Armco Steel Corp.

Joe Hales, New Mexico deputy mine inspector, was recently appointed safety and industrial hygiene technician for Chino Mines Division, Kennecott Copper Corp. Hales, who had been deputy mine inspector for southern New Mexico since 1955, was succeeded by **David P. Aker.**

William G. Stevenson has been named vice president of operations, Emerald Coal & Coke Co., a subsidiary of J. H. Hillman & Sons Co. Stevenson, formerly general manager of mines, has spent his entire business career of more than 37 years with J. H. Hillman & Sons and its affiliated companies. He has held a variety of positions including chief clerk engineering department, assistant division superintendent and division general superintendent.

Emerald also announces that **Clinton Carl Cornelius** has been named vice president of engineering. He had been general manager, United States Fuel Co. His prior associations were with Baton Coal Co. and Pittsburgh Coal Co.

Leslie M. Cassidy, former chairman and chief executive officer of Johns-Manville Corp., has been elected a director of Cerro de Pasco Corp. succeeding **Howland Bancroft,** who recently resigned.

W. J. Bennett recently resigned as president of Canadian-British Aluminum Co. to become vice president and director of Iron Ore Company of Canada. A former president and general manager of Eldorado Mining & Refining Co., Ltd., he became executive vice president and general manager of Canadian-British Aluminum in 1958 and in 1959 president and director. He will continue to serve his former company as a director.

C. Ward Padgett has left Bell & Zoller Coal Co. to become assistant general superintendent of Lone Star Steel Co. coal mines in Oklahoma.

Warren E. Fenzi, formerly assistant to the general manager in Douglas, Ariz., for Phelps Dodge Corp., has been appointed assistant to the president.

Rolland O. Baum has become president of Tennessee Products & Chemical Corp. succeeding **Carl McFarlin, Sr.,** retired.

Charles H. Sommer was recently elected president of Monsanto Chemical Co. and **Charles Allen Thomas** was selected chairman of the board of directors. Thomas had been president, and Sommer had been executive vice president. The board also elected Sommer chairman of the executive committee and a member of the finance committee.

F. C. Green, general manager of the Utah Copper Division, Kennecott Copper Corp., has been appointed assistant to the general manager, Western Mining Divisions. His new duties will involve operations at the company's Arizona, New Mexico, Nevada and Utah properties. Successor to Green is **J. P. O'Keefe,** who is being advanced from Utah Copper Division



F. Green



J. O'Keefe

comptroller to general manager.

Green joined Kennecott in 1924 and prior to his recent promotion, held positions including mill superintendent at Hurley, N. M., for Chino Mines Division; general superintendent, New Mexico operations; assistant general manager, Utah Division. He became general manager at Utah in 1958. O'Keefe joined Kennecott in 1949 and before coming to Utah, was assistant treasurer at Braden Copper Co., a Kennecott subsidiary.

J. Stanley Mitchell has been appointed mill superintendent at Southwest Potash Corp. He had previously been manager of research and development for Nickel Processing Corp. at Nicaro, Cuba.

John B. Henrich has been elected a director of National Lead Co. He succeeds **James A. Taylor** who retired in December after 47 years' service with the company.

D. W. Blend has been elected a director and vice president—operations of Calumet & Hecla, Inc. Blend, associated with C & H since 1942, will have charge of all the company's operating facilities among which are included six copper mines in the Calumet Division and the Marquez uranium mine near Grants, N. M., in the Uranium Division. C & H also announces that **Paul Dashine** has been named to the newly created position of president and general manager of the Calumet and Uranium Divisions. Dashine joined the company's Calumet Division in 1954 as industrial engineering manager. He advanced to director of engineering in 1956, a position he held until his present appointment.

Walter C. Bennett, chairman of the board, Phelps Dodge Refining Corp. has retired. Bennett joined the predecessor company, Nichols Chemical Co., in 1898 at the age of 15. By 1927 he had become vice president of Nichols, a position he held after the company was acquired by Phelps Dodge Corp. in 1930. He was elected president, a director and chief executive officer in 1935. In 1955 he became chairman of the board.

Eight western mining and metallurgical consultants have organized as an independent consulting association in Salt Lake City. Those entering into the association include: **S. S. Arentz,** former manager of Combined Metals Reduction Company's Nevada operations and for the past five years a consultant; **Robert R. Porter,** former metallurgist with Anglo American Copper Corp. and Rio Tinto, and consultant to Newmont Mining Co. and Utah Construction Co.; **Lockwood W. Ferris,** former president and general manager of Bonneville, Ltd., and consultant to Israel and South American governments; **J. Fred Johnson,** retired manager of operations, Western Mining Department, American Smelting and Refining Co.; **Sidney S. Alderman, Jr.,** former geologist, American Metal-Climax Corp. and consultant for Kern County Land Co.; **Jack O. Horton,** former oil exploration engineer for Socony-Mobil and general manager, Vitro Minerals Corp.; **Hoitt H. Ellerbeck,** former president Utco Products and presently operator of a manganese mine and mill in Mexico; and **Frank Anderson,** former mine accountant, management official, and metallurgical accountant for the Combined Metals Co. Headquarters for the organization will be at 520 East 4th South, Salt Lake City, Utah.

Charles B. Lakin was recently elected executive vice president and chief executive officer of Berwind-White Coal Mining Co. He was also elected to the same position in New River & Pocahontas Consolidated Coal Co. and Kentland-Elkhorn Coal Co., affiliates of Berwind-White. Lakin has been with the parent company since 1932 and has been a vice president since 1956. Other elections include: **Edward J. Behn** and **Charles G. Berwind, Jr.,** vice presidents, Berwind-White and the above-named affiliates; **Zeb G. Herndon,** vice president-lands, New River & Pocahontas; **Leroy A. French** and **Robert H. Seese,** assistant vice president, and general manager, respectively, of Berwind-White.



Charles E. Dunlap and **Charles G. Berwind,** president and vice president, respectively, of both companies, have retired but will continue in their positions on the board of directors.

Robert W. Braund has been appointed to the newly created position of manager of mines, Minnesota & Michigan Ore Divisions, Jones & Laughlin Steel Corp. In his new posi-



R. Braund



R. Balconi

tion Braund will be responsible for operations at the two mining divisions, which together supply about 50 percent of the company's iron ore requirements. Until the recent appointment, he had been manager of J & L's Michigan Ore Division since 1952. He joined the company in 1946 as assistant general superintendent, Michigan Ore Division.

At the same time, it was announced that **Russell L. Balconi,** formerly superintendent at the Tracy mine, has been named superintendent, Michigan Ore Division. Balconi joined J & L in 1947 as a mine captain after being with Pickands Mather & Co. for about 20 years. **Harry F. Kullberg** will continue to manage J & L's Minnesota Ore Division, which post he has held since 1953.

Quincy A. Shaw, Jr., has been named president of Bonneville, Ltd., succeeding Lockwood W. Ferris who earlier had resigned to do consulting work. Shaw is a vice president and a director of Mesabi Iron Co., and a vice president and director of North American Mines, Inc., a major Bonneville stockholder. **Robert D. Macdonald,** former assistant chief of the mineral processing division of Battelle Memorial Institute has been named vice president, and **Jesse V. Ecton,** former superintendent, has been promoted to company general manager.

E. B. Douglas, former general manager of Calera Mining Company's Cobalt, Idaho, operations has been named general manager of Manganese, Inc. He succeeds **W. L. Kendrick,** vice president and general manager, who will become general manager of Tungsten Corp. Both companies are Howe Sound Co. subsidiaries.

Obituaries

Armstrong Robertson Matthews, 57, president, Consolidation Coal Co., died suddenly in Honolulu, April 2, while enroute to Japan.



Mr. Matthews joined Consolidation Coal Co. in 1926 at Fairmont, W. Va., where he was a member of the engineering staff for the succeeding three years. In 1929 he was transferred to the operating department becoming successively division superintendent of the company's Pocahontas-New River Division and then the Fairmont Division. From 1933 to 1935 he was on the engineering staff of the Philadelphia and Reading Coal and Iron Co., and from 1935 to 1944 he was manager of operations and later vice president of Clover Splint Coal Co. He was employed by the Clinchfield Coal Corp. as executive president in 1944 and from 1946 to 1951 as president.

In 1951, Mr. Matthews accepted the presidency of Pocahontas Fuel Co. When Pocahontas Fuel and Pittsburgh Consolidation Coal Co. merged in 1956, he was named president of the combined companies, and shortly thereafter, the name was changed to Consolidation Coal Co. He was national chairman of the American Mining Congress 1957 Coal Convention and Exposition in Cleveland.

Daniel Harrington, 81, retired chief of the Health and Safety Division of the U. S. Bureau of Mines, died in Arlington, Va., March 24.

Mr. Harrington is credited with being one of the first to recognize explosion dangers in bituminous coal dust and he wrote widely on the subject. He was an internationally known authority on mine safety. He joined the Bureau of Mines in 1914 and became chief safety engineer in 1926. He was named chief of the Health and Safety Division in 1935 and headed that division until his retirement in 1948.

Frederick F. Kett, 78, retired general manager — mining department, Vanadium Corp. of America, died March 13 at San Mateo, Calif.

Mr. Kett's long and colorful career in the mining industry took him to four continents as a consultant and engineer. Although he was associated with Vanadium Corp. during the early 1920's it was not until 1935 that he joined the company permanently. In 1939 he was appointed general manager of the mining division, in which position he served until retiring in 1950.

Carl T. Ulrich, 74, retired executive vice president, treasurer and a director of Kennecott Copper Corp., died in New York City, February 28. He had retired in 1951.

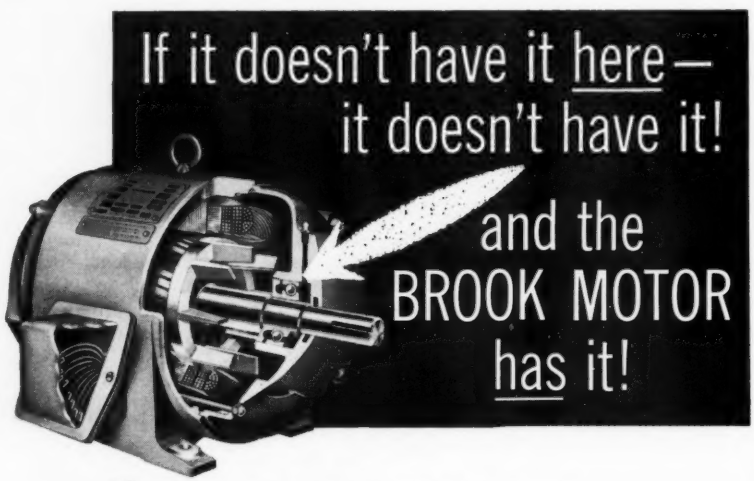
Noble H. Getchell, 85, president and a director of Getchell Mine, Inc. died February 10 in Auburn, Calif.

Mr. Getchell had become president of the company following the death of George Wingfield who died in December 1959. The two men were cofounders of Getchell Mine.

Ephraim H. Brown, secretary and director of the Ohio Brass Co., died minutes after suffering a heart attack in Washington, D. C., on March 23.

Mr. Brown, whose entire business career was spent at Ohio Brass, joined the company in 1924. He served in the Power Utilities and General Sales Department before being elected to the board of directors in 1947 and secretary of the company two years later.

Laurids Lewed Jessen, a former president of Boyles Brothers Drilling Co., died in Vancouver, B. C., recently at the age of 70. Under his leadership Boyles Bros. expanded its activities into the manufacture of drilling equipment and became a world-wide contract drilling company.

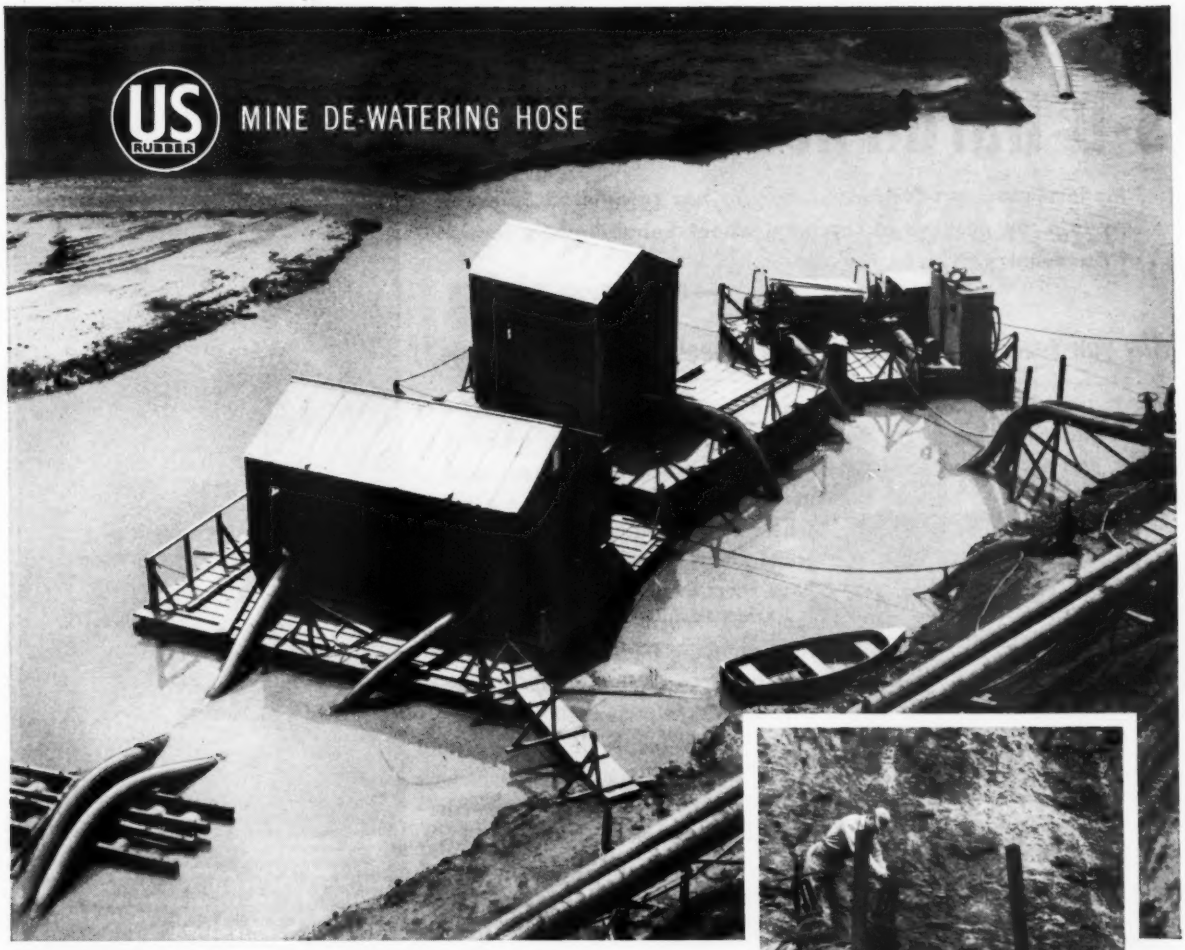


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This hose is mounted on floating rafts, where its extreme flexibility allows it to rise and fall with the water. Yet despite its flexibility, it withstands pressures up to 350 lbs.—as compared with the 250-lb. top pressures of conventional fabric-built hose.

U.S. Mine De-Watering Hose is the one sure way of controlling subterranean streams within the mine, as well as controlling heavy rains and snows that could cause floods and work stoppage. The dependable stamina of this hose is one reason why U.S. Rubber is the largest manufacturer of the widest range of industrial rubber products serving industry.

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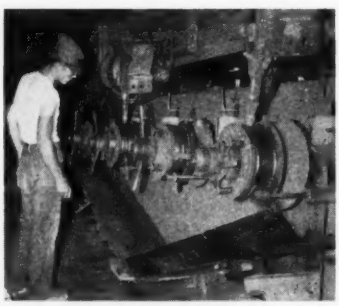
Increase the life of your wheels with S-D Hard-Faced Treads and Flanges...

"Modern mass-production equipment has catapulted Sanford-Day into the position of top mine wheel 'rehabilitation center' of the country."

—Fusion Facts

Why you save on S-D Hard-Faced Wheels (New or Reclaimed)

For years wheels like the one at right had to be discarded. Its (1) Tread and (2) Flange are "worn-out". But otherwise the wheel is as sound and serviceable as a new one. We have solved the problem of getting **wearing material** on a wheel where it does some good . . . **on the tread and flange where it is used!** We have reclaimed thousands upon thousands of "worn" wheels by successfully applying high alloy materials to the tread and flange of discarded wheels. These reclaimed wheels have earned such favorable savings, and due to oftentimes tripling their service life, many users have been ordering **new wheels** S-D Hard-Faced. They save the cost and down time of changing and reclaiming wheels when ordinary wheel flange and tread wear out.

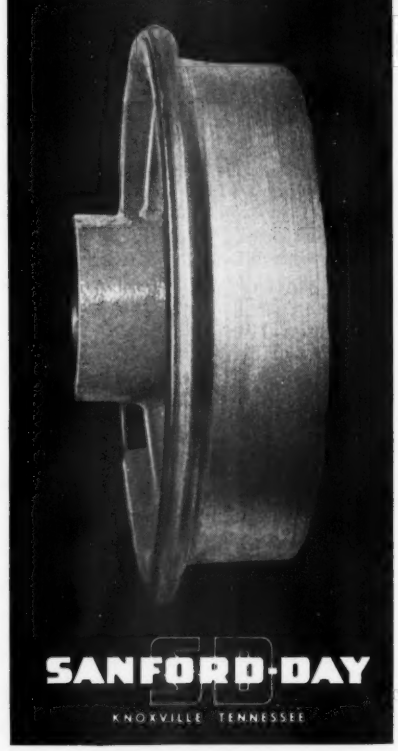


Several completely automatic fixtures, such as this one, were developed at Sanford-Day in cooperation with the welding industry to mass-produce S-D Hard-Faced new wheels and reclaim old ones. Heads are shown here depositing high alloy on treads. A different alloy is used on flanges. Secret of long wheel life is obtaining wheels furnished with wearing surface on treads to take "impact", while wearing surface on flanges will take "scrubbing". S-D Hard-Facing assures you maximum and equal service of both tread and flange!

What counts is the proper alloy on the tread and flange! Over given period of time your wheel requirements will be reduced substantially when you order and use S-D Hard-Faced Wheels. Write us today for BULLETIN E-100 that furnishes complete information and specifications. **Sanford-Day Iron Works, Inc., P. O. Box 1511 . . . Telephone 3-4191, Knoxville, Tennessee.**

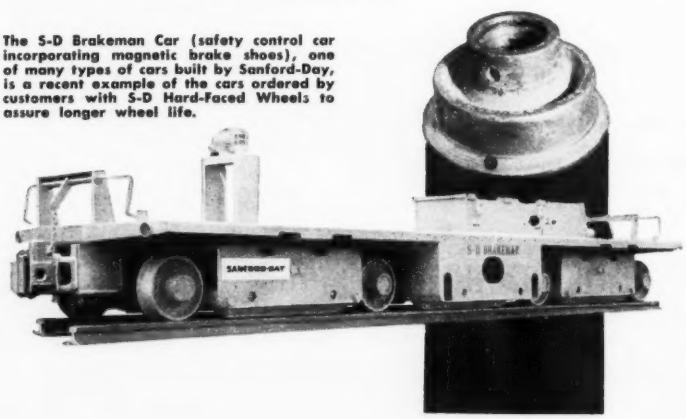


Worn wheel above shows typical condition of wheels formerly discarded. Field reports and customer experiences with S-D Hard-Faced Wheels show that reclaimed wheels, like one below, often give three times the service life of unprotected ones at far less than new part cost.



Pictured below is a test wheel after many months service in severe service. It shows no appreciable wear on the S-D Hard-Faced tread and flange.

The S-D Brakeman Car (safety control car incorporating magnetic brake shoes), one of many types of cars built by Sanford-Day, is a recent example of the cars ordered by customers with S-D Hard-Faced Wheels to assure longer wheel life.



NEWS and views



Lead, Zinc Groups Elect Officers

Jean Vuillequez, vice president, American Metal Climax, Inc., was elected president and chairman of the board of directors of the Lead Industries Association at its 32nd annual meeting in April. Joseph A. Costello, vice president, the Ethyl Corp.; Charles R. Ince, vice president, St. Joseph Lead Co.; and Simon D. Strauss, vice president, American Smelting & Refining Co., were elected vice presidents. Robert L. Ziegfeld continues as secretary-treasurer.

At the annual meeting of the board of directors of the American Zinc Institute, its entire slate of officers was re-elected to serve for another year—as president, R. G. Kenly, vice president, the New Jersey Zinc Co.—as vice presidents, T. A. Campbell, Anaconda Sales Co.; H. D. Carus, Matthiessen & Hegeler Zinc Co.; E. H. Snyder, Combined Metals Reduction Co.—as treasurer, G. H. LeFevre, U. S. Smelting Refining & Mining Co.—as executive vice president and secretary, J. L. Kimberley, New York City.

Salvati Forecasts Increased Demand for Coal

R. E. Salvati, president, Island Creek Coal Co., told the East-Central District members of the American Institute of Electrical Engineers at its recent meeting in Charleston, W. Va., that "within the next 10 to 15 years, demand for bituminous coal will reach 600,000,000 to 700,000,000 tons annually."

He urged all large consumers, and especially the electric utility companies, to join the coal industry in planning for capacities to meet this added demand which, he said, will cost billions of dollars. "This future coal supply," Salvati told the group, "can be assured only by concerning yourselves with the problem and, working jointly with us, devising the most beneficial solution to our joint interests.

"You are going to need more and more coal," Salvati said. "We want to supply you with more and more coal, but at today's high capital costs we can't afford to develop new coal properties not assured of a market, at profitable prices."

"The solution," Salvati stated, "lies in a combination of the long-term coal contract, backed up with dedicated coal reserves, and volume movement agreements with the railroads. Such a combination," he said, "represents the type of 'big thinking' required for the 'big job ahead.'"

While forecasting great growth opportunities for all fuels, chemicals, industry, and utilities in the 1960–1970 decade, Salvati said, "The coal industry's planning must commence with a present-day appraisal of our present-day condition and its impact on the future." Salvati told the members that "the coal industry has a 500,000,000-ton capacity competing momentarily in a 425,000,000-ton market; and consumers are engaged in hand-to-mouth buying and pitting one supplier against the other in the interest of lower prices with no evidenced concern that they are buying much of their coal supplies well below cost, thereby stifling the replacement and expansion on which they must so heavily rely in the future."

McCulloch Named President of Roberts & Schaefer

Activities of Roberts & Schaefer Division of Thompson-Starrett Co., Inc., have been separated into two fields—engineering and construction of coal preparation facilities and related material handling equipment fields, centered in Chicago; and architectural and engineering work performed, for the most part, in New York City and Los Angeles, Calif.


W. McCulloch

The Chicago operation will be directed by a management group consisting of William C. McCulloch, president; R. G. Miller, Jr., vice president-sales; Jos. F. Peyronnin, vice president-operations; and William A. Mullen, vice president-treasurer.

McCulloch's first business connection was with Pacific Coast Coal Co., Seattle, Wash., as coal washing engineer. In 1924 he went to work for the U. S. Bureau of Mines as a coal mining engineer. From 1925 to 1929 he was laboratory manager for Heyl & Patterson, Inc., Pittsburgh, Pa.; and from 1930 to 1934, he was chief chemist for Koppers Rheolaveur Co., Wilkes-Barre, Pa. In 1935 he joined the United Electric Coal Companies' staff as preparation manager, and from 1941 on has served Roberts & Schaefer Co. in that same capacity.

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U. S. Company to Finance Canadian Drilling Project

American Metal Climax, Inc., plans to finance a diamond drilling program on the South Onaman area base metal property of New Bidlamaque Gold Mines. The property is located in the Nipigon Forest Reserve, about 35 miles west of Geraldton, northwestern Ontario.

The financing will be undertaken by Southwest Potash Corp., a wholly-owned subsidiary of American Climax. Southwest is to reimburse New Bidlamaque for all expenditures made on the property to date, and undertakes to spend a minimum of $30,000 on the drilling program.

If requested by Southwest, New Bidlamaque will call a special meeting of shareholders by May 15 of this year to authorize formation of a new 6,000,000-share company to acquire the property. New Bidlamaque would receive 2,000,000 shares. After Southwest has spent $500,000 on exploration, it will be entitled to purchase the remaining 4,000,000 shares for $2,000,000. In addition, Southwest undertakes to advance up to $10,000,000 against notes or debentures to put the property into production if warranted.

An additional clause in the agreement provides that the new company can demand that either New Bidlamaque or Southwest turn over to it any claims acquired by either lying within five miles of the present 42-claim group.

Open Pit Mining Association Schedules Annual Meeting

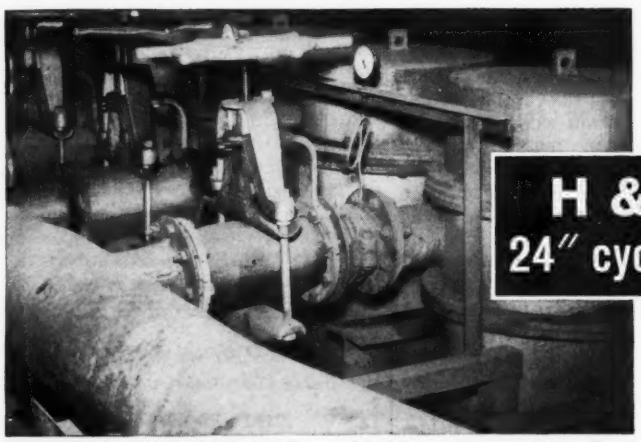
The sixteenth annual meeting of the Open Pit Mining Association will be held in cooperation with Purdue University at Lafayette, Ind., on June 9, 1960. G. H. Utterback, secretary-treasurer, United Electric Coal Companies, will be master of ceremonies. Subjects to be covered include high voltage power distribution systems and principals of modern control systems for large excavators.

ALSO . . .

The Lead Industries Association and the American Zinc Institute have jointly leased the entire 14th floor of the office building at 292 Madison Avenue, New York City. The two associations will use the new offices to expand their research and market development activities.

Marion Type 7400 Electric Walking Dragline equipped with 165 ft. boom, two 13 cu. yd. Esco buckets, and 2500 ft. of feeder cable. Two years old, and in very good condition. Can be inspected where working in coal mine in West Virginia. Available very soon. Offered F.O.B. Cars.

Inquire: Bruns Coal Company, 330½ Market St., Zanesville, Ohio. Phone: GLadstone 30351



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55 FORT PITT BLVD., PITTSBURGH 22, PA.

Pittsburg & Midway Coal Mining Co., Pittsburg, Kans., has been awarded a contract to excavate and remove about 35,000 tons of coal from the site of the Paradise, Ky., steam plant. TVA had invited bids on the basis of excavation and removal of the coal and of excavation of and stockpiling for TVA's use. Pittsburg & Midway was the only bidder on the mine-and-keep basis.

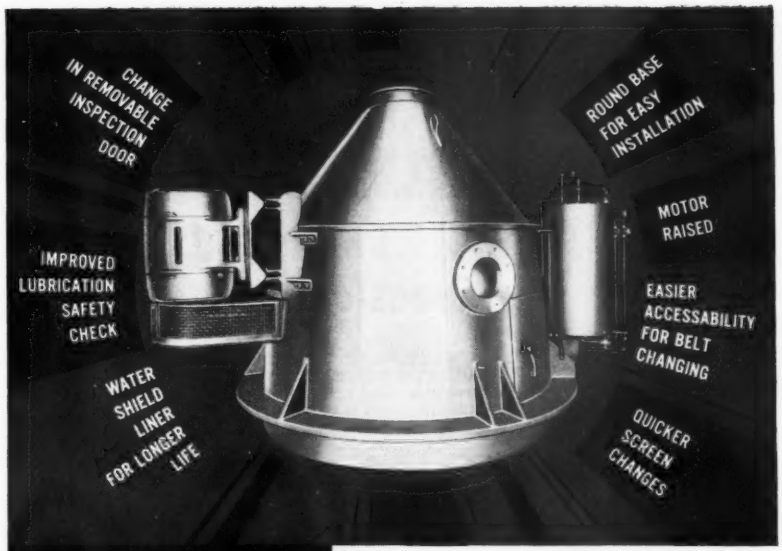
Foote Mineral Co. has authorized purchase of a 670-acre tract of land in the New Johnsonville, Tenn., area. The tract will be studied as a site for a new electrolytic manganese facility.

The 1960 Appalachian Underground Corrosion Short Course will be held at West Virginia University, Morgantown, W. Va., on June 1, 2, and 3. There will be 54 classes and a number of field demonstrations.

Armco Steel Corp. recently announced that it has produced its 100,000,000th ton of steel. Founded almost 60 years ago, the company is sixth largest in the steel industry. Annual capacity of its steel producing furnaces is 6,800,000 tons or more than 18,000 tpd.

The School of Mines at West Virginia University, through its Mining Extension Department will offer the Tenth Annual Short Course in Coal Preparation at Morgantown, June 6 to July 15, 1960. The course is designed for the practical man actively associated in his regular employment with the cleaning and preparation of coal to meet market specifications. A complete range of laboratory equipment and facilities is available for the program, including pilot units for the commonly used coal cleaning methods and equipment. A complete washability study of a typical coal is made as a part of the laboratory exercises and the corresponding washability and size consist curves are developed and analyzed. Emphasis is given to fundamentals to provide effective instruction in the principles and practices of coal preparation. Further information may be obtained by writing the university.

The coal-hydrogenation works at Most, Czechoslovakia, which converted coal to liquid fuel for Germany's army during World War II, is the subject of a technical report just placed on open file by the U. S. Bureau of Mines. The plant was modified after the war to use tars as raw material, and information in the report was obtained by the Bureau as part of research on low-temperature coal tars. Copies of the report, which is titled "The Most Hydrogenation Works in Czechoslovakia," can be inspected during regular working hours at the Department of the Interior library in Washington, D. C., and at Bureau of Mines libraries in Pittsburgh, Pa., Morgantown, W. Va., Grand Forks, N. D., Denver, Colo., and Minneapolis, Minn.



NEW IMPROVEMENTS IN CMI CONTINUOUS CENTRIFUGAL COAL DRYERS

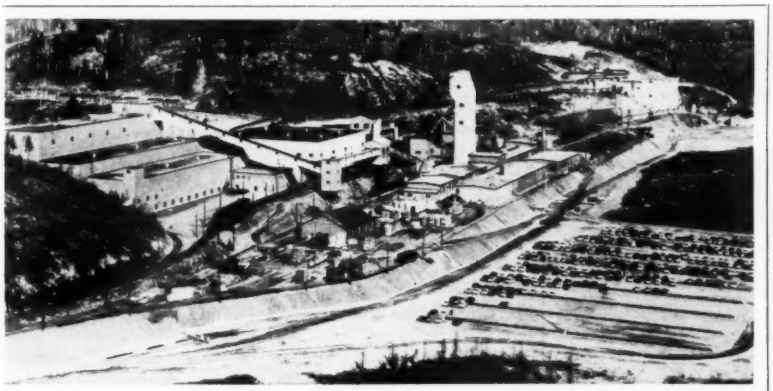
CMI has developed, for the 1960 Model EB-36 Coal Dryer, several significant improvements. Among these are the raising of the motor for easier installation and the redesigning of the removable inspection door for ready access to the interior.

The 1960 EB-36 Dryer is a precision-built, excellently machined, dependable dryer which will reduce 35% surface moisture in coal to less than 5% at the rate of 65 tons or more per hour.

CMI service is available from any one of three strategic locations.

Write for illustrated Brochure No. EB-36 for complete details.

CENTRIFUGAL & MECHANICAL INDUSTRIES INCORPORATED
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CMI



INCO OPENS NEW MILL IN CANADA

A highly automated ore milling plant has been opened by The International Nickel Company of Canada, Ltd., in the Sudbury area of Ontario in the latest step in a continuing program to counter rising costs with increased production efficiency through technological advances. Located at INCO's Levack mine near Copper Cliff, Ontario, and built at a cost of $12,000,000, the mill makes extensive use of instrumentation to permit centralized, and in some cases automatic, control of the crushing, grinding, flotation, and dewatering processes involved in the production of concentrates from ore. All operations are controlled from centrally located instrument panels. Many recently developed techniques, such as the use of radioactive isotopes for making density measurements, have been incorporated into the new plant.

Hooker Chemical Corp. has approved $6,373,000 for construction of a third phosphorous furnace to reduce phosphate rock at the Columbia, Tenn., plant. The new electric furnace will add 20,000 tons per year of elemental phosphorous capacity to Hooker's present capacity of 45,000 tons per year at the Columbia plant.

Kentucky Power Co., a subsidiary of American Electric Power Co., plans to build a $39,000,000 coal-burning electric generating plant near Louisa, Ky. Construction will begin about June 1, and completion is expected by the fall of 1962. The plant will consume approximately 750,000 tons of coal a year and will have a capacity of from 250,000 to 265,000 kw. All the coal will be purchased from mines in eastern Kentucky.

Canada's search for mineral wealth will be extended to the bottom of the Arctic sea by a special oceanography station to be built near Halifax, Nova Scotia, and a proposed 4000-ton oceanographic ship, according to Dalhousie University's Department of Oceanography.

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DEPENDABLE roof support
with
PATTIN
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expansion shells



STYLE D-1

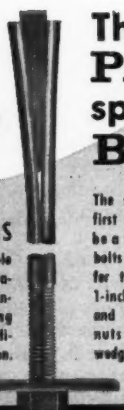
The unique double expansion feature of all Pattin expansion shells insures *dependable* roof support, in hard or soft roof conditions. Their double holding power guards against failure — even under a 20 ton pull!

Pattin features include a parallel contact with the hole, and no definite drilling depth is required, as the shell can be securely anchored at any place in the hole. They anchor solidly and will not turn while being tightened. Wedge and shell are assembled in a manner to prevent loss of parts in handling, and the bolt and shell assembly are furnished as a complete unit. Plates are bundled separately. No special nuts or ears are required on the bolts. These features make a safer roof — and a safer roof means fewer accidents, increased production, more clearance for equipment operation and better ventilation.

Pattin specializes in roof bolting —it's our business, not just a sideline! Your business is important to us, and our service engineers are always available for consultation on your roof problems—ready to give you service when you need it! WRITE OR PHONE US TODAY for complete details.

Reg., U.S. and foreign Pat. Offices





The PATTIN split-type BOLT

The split-type bolt is one of the first slotted bolts, and continues to be a favorite wherever split-type bolts are used. Many mines still prefer this type. The bolt is a full 1-inch in diameter, with cut threads and furnished with hex or square nuts and various size plates and wedges.

IN WESTERN STATES

Pattin expansion shells are available and serviced exclusively by Colorado Fuel and Iron Corporation, Denver, Colorado. Western mining companies should contact them direct for information and consultation.

PATTIN
MANUFACTURING COMPANY
MARIETTA, OHIO

The PIONEER of roof bolting . . . established 1888

West Virginia has deeded to Consolidation Coal Co., for $10,000 about 11 acres of coal lying beneath the Ohio River bed in the vicinity of 16th Street in Moundsville. Consolidation wanted the acreage in connection with possible future development of large coal reserves it owns on the Ohio side of the river.

A new access slope and ventilating shaft is scheduled for the gypsum mine of Bestwall Gypsum Co. in northeastern Kansas. The mine will serve Bestwall's new plant at Blue Rapids. The slope, semi-circular in shape with an eight-ft radius, will be 572 ft long, terminating in a 45 by 30 by 27-ft crusher chamber. The seven-ft diam circular shaft will be 95 ft deep. Walls of the slope will be reinforced with steel liner plates, and concrete grout will be placed behind them.

Iron Ore Co. of Canada is taking steps to open a new iron ore area, known as the Wishart Lake section, near its iron-producing center of Schefferville, Quebec. The Wishart mine is expected to eventually produce more than 2,000,000 long tons of iron ore annually.

In 1959 the 50 biggest coal mines produced 88,290,541 tons, or 21.5 percent of the national total of bituminous and lignite coal, according to *Keystone Coal Buyers Manual*, a McGraw-Hill publication. The biggest underground mine in 1959 was Peabody Coal Company's Pawnee No. 10 mine in Illinois, with 3,764,146 tons. The biggest strip mine was Consolidation Coal Company's Georgetown mine in Ohio, with 2,648,900 tons. Thirty-eight of the "50 biggest" are underground mines.

Lead Industries Association, 292 Madison Ave., New York 17, N. Y., has announced the availability of "Industrial Truck Cost Calculator." The 12-page brochure is said to make it possible to estimate, in a matter of minutes, the costs incurred by industrial trucks. So far as is known, this is the first time that nomographs or alignment charts have been available to show costs of depreciation, operation, and maintenance accurately for both gasoline-powered and battery-powered trucks. To perform the complete estimation, the truck user will need to know the purchase price of the trucks, the useful life to be expected, gas and oil consumption in the case of gas trucks, the maintenance labor wage rate and replacement part costs. Because some or all of this information may not be readily available for every plant, the brochure includes tables and values for all these factors based on known prices and surveys of all types of truck operation.

The Tennessee Coal & Iron Division of U. S. Steel Corp. recently celebrated its 100th birthday after starting out as a coal mining company producing two carloads daily.

The Norfolk & Western Railway plans to spend $12,000,000 on the construction of coal hopper cars.

Woodward Iron Co. plans to build an ore sintering plant at its Woodward, Ala., operations this year as part of a $2,000,000 capital spending program. Installation of a new turbo-blower for blast furnace operations is also included.

North American Coal Corp. has sold its East Gulf Pocahontas mine near Beckley, W. Va., to Winding Gulf Coals, Inc. Winding Gulf, major producer of Pocahontas No. 4 and Beckley seam coals at its five mines in the Winding Gulf district, through the acquisition of North American's East Gulf property, will thus diversify its operation with the addition of the North American Pocahontas No. 3 coal. Winding Gulf controls large reserves of No. 3 coal adjacent to North American's East Gulf mine and plans to assign part of this acreage to the East Gulf operation.

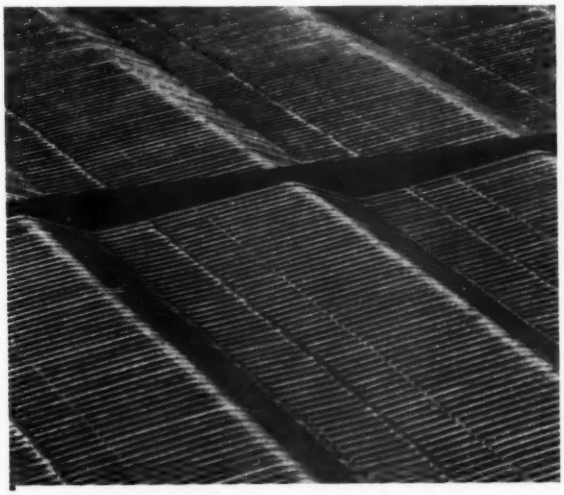
Cooperating with mine owners and state and private agencies, the Ohio Agricultural Experiment Station at Wooster is conducting tests to determine spoilbank makeup and reclamation possibilities. Purpose of one project which began January 1959 is to obtain more basic information on the changes in physical and chemical properties of coal spoil, its leachate (drainage) and atmosphere due to weathering conditions. Another project began several years ago when an unusual tree was found growing near East Fultonham, Ohio. The tree, described as a prostrate mutant of the black locust, grows horizontally instead of vertically as trees commonly do. In tests to date, the prostrate black locust has shown great promise as a ground cover for spoil banks. It takes on added value if planted with other types of vegetation in that it is an excellent nitrogen provider—spoils lack nitrogen.

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"STEP" CONSTRUCTION!

Now you can almost double your small coal screening capacity and eliminate flooding caused by overloads. Hendrick's new Wedge Wire CASCADE Screen has a special "step" construction that breaks up the flow layer and causes a tumbling action to greatly improve dewatering efficiency.

CASCADE increases draining to such an extent that you can use smaller screens to achieve the same throughput as before and save on space and material costs. Hendrick Wedge Wire CASCADE Screens are furnished with openings from ¼ to 1 m.m., in anti-corrosive stainless steel. For more information, mail in the coupon today!

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Wheels of Government

(*continued from page 74*)

range, timber, watershed, and fish and wildlife purposes." The bill is now in the House Rules Committee, which will decide whether to clear it for a House vote.

Chairman Aspinall (Dem., Colo.) of the House Interior Committee has been critical of the bill and may oppose it before the Rules Committee. In a letter to Chairman Cooley (Dem., N.C.) of the Agriculture Committee, Aspinall suggested adding prospecting and mining and water supply to the listed purposes, but his suggestion was ignored. That Committee's report on the measure contains only this reference to mining: "It is made clear that nothing in the bill would affect the authority which the Secretary of the Interior has with respect to the mineral resources in the national forest lands. Thus, the bill would not impair mining operations and activities under the authorities which the Secretary of the Interior has with respect to such mineral resources."

Aspinall also said the bill may raise the question of whether the Forest Service is properly a division of the Department of Agriculture rather than the Interior Department. "I think it is clear, at any rate, that the Forest Service has evolved from an agency primarily concerned with watershed protection and raising timber as a crop to a general land-management agency concerned to a major extent with recreational (park), fish and wildlife, mineral, and grazing matters, in addition to forestry matters, in the administration of public lands," Aspinall's letter to Cooley concluded.

NEWS and views



Conveyor to Service Open Pit

United States Borax & Chemical Corp. has begun installing a 1300-ft conveyor system at its Boron, Calif., open pit mine. Scheduled for completion in the fall, the system will provide increased flexibility to meet future ore demand, lower transportation costs from the mine to the adjacent surface plant, and greater safety over the present haulage method.

Eight trucks currently travel 2½ miles to haul ore from the pit to a surface crusher. The conveyor system, with a vertical lift of 315 ft, will provide a continuous link between the mine and plant. Trucks will still be used to transport ore from pit shovels to a hammer mill to be installed at the tail end of the conveyor system.

Open pit mining at Boron began in 1956 and today the pit measures 2000 ft long, 1700 ft wide and 275 ft deep. At current production rates, ore reserves are said to be sufficient to last in excess of 100 years.

National Safety Council Award to MCJ

For its efforts in promoting safety in the mining industry in 1959, the National Safety Council has named *Mining Congress Journal* as a recipient of its Public Interest Award.

The noncompetitive award annually honors exceptional service to safety by organizations in the mass communication field. Established in 1948, the Public Interest Award recognizes leadership, initiative and originality in the furtherance of accident prevention by the mass media.

Utah Phosphate to be Exploited

Construction of a major phosphate rock crushing and beneficiation plant at Vernal, Utah, has begun. San Francisco Chemical Co., who earlier had been reported planning to work the huge Vernal phosphate deposits, is now building a facility for production of 200,000 tons of phosphorite concentrate per year. The plant is scheduled to be completed by November, and after operations commence, concentrates will be shipped 200 miles by truck to Western Phosphates Inc. at Garfield, Utah. There it will be used as raw material for manufacture of wet process phosphoric acid, treble super phosphate and ammonium phosphate. Western Phosphates is owned 50 percent by Stauffer Chemical Co. and 25 percent each by American Smelting & Refining Co. and Kennecott Copper Corp.

In other developments, it is reported that Utah Power & Light Co. will build a $2,360,000 high voltage transmission line into the Vernal area. This foretells the possible future erection of elemental phosphorus furnaces at Vernal and further development of the resources of the Unitah Basin.

Canadian Coal Sought

An option on coal deposits in British Columbia, owned by Crow's Nest Pass Coal Co., is reportedly being sought by U. S. Steel Corp. Under the proposal, U. S. Steel, for $10,000,000, could purchase coal deposits owned but not now being operated by Crow's Nest. An alternative proposal would involve purchasing all Crow's Nest coal properties for $17,000,000. The option would be held by Columbia Iron Mining Co., a U. S. Steel subsidiary. Approval of either option by Crow's Nest stockholders would obligate U. S. Steel to make expenditures of $500,000 on the properties over the next four years. Crow's Nest has about 250,000 acres of coal rights.

In an earlier development it was reported that Japanese steel-making interests had ordered 225,000 tons of coal from Crow's Nest—the largest coal order ever placed in Canada by the Japanese.

Beryllium and Cesium Sought

Intensive exploration in the Pacific Northwest for beryllium and cesium is being undertaken by the Spokane, Wash., office of the U. S. Bureau of Mines. New and potential uses for the metals indicated a future need for domestic ores, and Bureau engineers using a laboratory truck are scheduled to conduct field investigations in Idaho, Montana, and Washington. The Idaho Bureau of Mines will provide members of its staff for advance reconnaissance and geological studies in its area.

In a related development, the Bureau's Rolla, Mo., Metallurgy Research Center has devised a simple, reliable and sensitive method for detecting beryllium in concentrations as low as 0.013 percent. Although it is a chemical test, it can easily be performed in the field. Employment of the test may lead to discovery of beryllium in rocks and minerals not previously suspected to contain it. The test is the subject of Bureau of Mines Information Circular IC-7946, "Field Test For Beryllium," which is available at 15 cents per copy *only* from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

ALSO . . .

Exploration for gold is slated for the Iditarod mining district in the Flat area of western Alaska. A Canadian firm, Alaska-Canadian Mining & Exploration Co., Ltd., is reported planning sizeable expenditures for surface and subsurface prospecting work on a property on Chicken Creek Dome in search of a mineable lode. Part of the area has been mined by placer methods, but almost no hard rock mining has been done.

Underground mining of manganese by block caving or stoping methods is planned by Manganese, Inc., for the Hewlan pit near Boulder, Nev. The company has awarded a contract to Mines Contractor, Inc., of Wickenburg, Ariz., to mine 30,000 tons of high grade manganese ore to blend with and upgrade open pit ore. Isbell Construction Company's contract for the open pit work has been extended to include additional stripping of 176,000 cu yd of overburden in order to mine 63,000 tons of ore in pit "A."

Interest in a coke making plant utilizing sub-bituminous coal has resulted in U. S. Steel Corp. joining Food Machinery & Chemical Corp. in a pilot plant venture near Kemmerer, Wyo. Food Machinery seeks to develop a successful method of producing metallurgical coke from subbituminous coal available in the Kemmerer area. U. S. Steel's interest in the process lies in the fact that the Kemmerer plant could be a source of coke for steel making facilities in western United States.

Forty-seven patented and 49 unpatented mining claims were included in the recent purchase of the Alta-St. Louis mine near Telluride, Colo., by Silver Mountain Mining Co. The Illinois company anticipates rehabilitating the property which was closed down following a mill fire in 1948. Plans call for a 100-ton mill. Alta-St. Louis is primarily a gold and silver producer with lesser values in lead and copper.

A new mine production record was set at the potash operation of International Minerals & Chemical Corp., Carlsbad, N. M., February 14, when a total 15,019 tons of langbeinite and sylvite ore were hoisted in a 24-hr period. The average tons per day hoisted during February established a new record although the total tonnage for the month was slightly less than the record 407,759 tons brought to the surface in January.

Exploration at the Anderson open pit mine of Goldfield Consolidated Mines Co., in northeastern Washington, has revealed sufficient zinc ore to warrant an expanded diamond drilling program. Discovery of the orebody was the result of diamond drilling during 1959. The company hopes to discover and develop enough reserves to justify a 1000 to 1500 tpd mine and mill at the property which has been shutdown since 1952.



Reliable Stratoflex Hose and Fittings will reduce downtime and maintenance costs.

Stratoflex Hose Assemblies are designed to withstand a combination of high pressure and surges; they also afford the maximum abrasion resistance required on hydraulic control systems of continuous miners. Stratoflex Fittings provide a vibration-proof, leak-proof connection. Where quality is of the essence, specify Stratoflex on original equipment. With a supply of Stratoflex Hose and Fittings on hand, the operator can conveniently make up hose lines on the job, thus reducing costly downtime.

Shown above is a typical installation where Stratoflex is giving economical, dependable service.

For complete information on Stratoflex high pressure hose and fittings, write for Bulletin S-2.

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Sabre-Pinion Corp. is reported to have acquired a series of uranium mining leases in McKinley, N. M., from Westwater Corp. for $750,000. Sabre-Pinion is associated with Homestake Mining Co. through a partnership in the Homestake-Sapin Partners uranium mining and milling operation near Grants, N. M.

Seven million dollars will be spent by Mt. Isa Mines, Ltd., of Queensland, Australia, in connection with plans to nearly double its milling capacity. The expansion will enable the company to treat about 14,000 tpd. Mt. Isa is controlled by American Smelting & Refining Co.

A $128,500 loan was reportedly made recently to United States Mining and Milling Corp. by the U. S. Small Business Administration for capital improvements, operation funds, supplies and additional equipment at its properties in Nye and Esmeralda Counties, Nev. The company operates a 300-tpd mill at Silver Peak, Nev., to treat gold and silver ores from three of its own mines in the Tonopah area. United States Mining and Milling produced about one-third of Nevada's silver output of 619,000 oz during 1959.

Uranium ore reserves of the Anaconda Co. at its properties near Grants, N. M., have been increased by outlining a new and important orebody during development of the Laguna concession. The orebody, called the Paguate, even though said to contain ore of higher grade than that in the company's Jackpile mine, will not be mined until after 1966.

Hercules mine, a major silver-lead-zinc producer in the Coeur d'Alene mining district of Idaho from 1902 to 1925, which was dewatered during 1947 and 1948, will again be allowed to partially fill with water. Day Mines, Inc., operators of the Hercules, had reportedly spent about $4,000,000 since 1947 searching for new ore bodies at the property and produced about 204,000 tons of ore. At the company's Dayrock mine, a new vein, named the Hornet, was discovered in December 1959. Subsequent drifting developed an oreshoot 205 ft long and eight ft wide averaging about 10 percent lead and 10 oz silver per ton.

The San Xavier mine and surface plant of McFarland and Hullinger in Pima County, Ariz., has been acquired by Banner Mining Co. under a lease and option arrangement. Seventeen patented and 52 unpatented mining claims and three claims covered by State leases adjoining Banner's Mineral Hill property are involved in the transaction. Although the mine is presently inactive, it is being kept dewatered to the 820-ft level and the shaft is being maintained.

A joint undertaking in Utah's Park City mining district between Keystone Mining Co. and United Park City Mines Co. could result in discovery and development of a substantial lead-zinc-silver orebody there. The companies propose to develop and mine an area underlying Keystone's property, previously believed mined out, and accessible from United Park's Alliance tunnel and Thaynes and Silver Hill shafts. The project would involve drifting and crosscutting. Under terms of the agreement between the two companies, each would get equal shares of any profits while Keystone would be obligated to pay United Park for use of its underground facilities.

Plans have been completed for placing the Salmon, Idaho, mill of Nuclear Fuels and Rare Metals Corp. in operation. The company has announced that the $250,000 100-tpd facility will now be available for concentrating and upgrading thorium and rare earths from ores available at its properties in the Lemhi Pass area of Montana and Idaho. The company also reports that it has acquired holdings—which it values at $11,000,000—of Salmon Uranium and Idaho Thorium Companies. Two million tons of ore are stated to be ready for mining, and reserves are estimated at 100,000,000 tons.

See-Tee Mining Corp., wholly owned subsidiary of Central Transformer Corp., and successor to Holly Minerals, has been sold to private investors identified as W. Rodney DeVilliers, Ray L. Schultze and Miss Stella Dysart. Sale price was not disclosed. DeVilliers and Schultze recently resigned from administrative positions with Hidden Splendor Mining Co. to assume management of See-Tee.

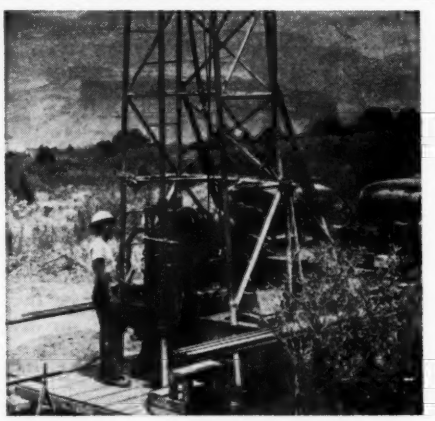
Paymaster Mines, Inc., is preparing to mine a copper-gold-silver-tungsten ore at a group of claims it has under lease near Pateros, Wash. The company, which has installed a 50-ton gravity mill at the property, plans to ship a copper-gold-silver concentrate to the Tacoma smelter and to stockpile tungsten. Mining activity in the area has been virtually dormant since the turn of the century.

WHAT ARE YOUR RESERVES?

•

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Coal in Kentucky . . . Uranium on the Colorado plateau . . . Bauxite in the Ozarks . . . Limestone in Pennsylvania . . . Copper in Montana . . . These are but a few examples of the extent of our operations. Throughout the United States and even in many foreign countries we have successfully explored and proved ore reserves for our many customers, and where normal methods have failed, special techniques have been developed. In the Gas Hills Area of Wyoming, for example, we successfully cored the loose sand and siltstone where others had failed by "freezing" the material. Our personnel and equipment are stationed throughout the United States awaiting your call.

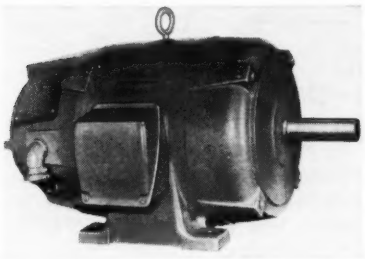
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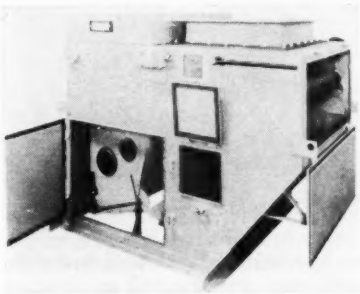
manufacturers forum

WOUND ROTOR Life-Line "A" induction motors are designed primarily for adjustable or constant speed drives that require special starting characteristics. They cover all standard ratings in frame sizes 254 through 326, which represents motors from 2 to 30 hp up to 1800 rpm. Superseding the types CWP and CIP wound rotor motors, the new line incorporates a class B insulation system and features sealed-for-life, lubricated ball bearings. Motors are supplied with leads for external connection for either 220 or 440 volts.



For more information, write Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa.

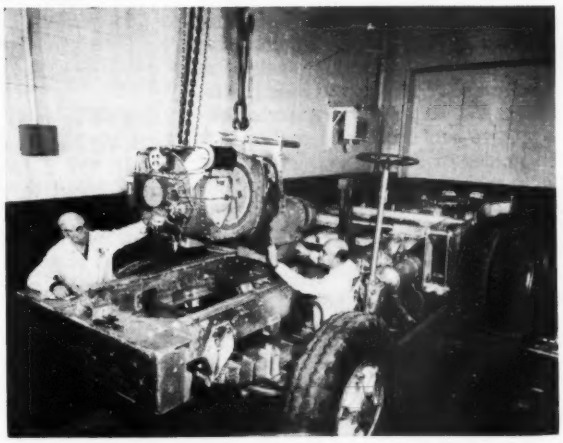
AN AUTOMATIC COAL SCALE, called the Richardson H-39C, expedites inspection and maintenance to all parts through unusually large access doors, according to Richardson Scale Co., Clifton, N. J. The doors,



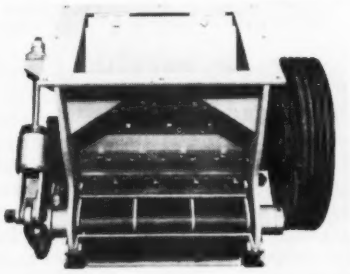
provided on all four sides of the scale, fit flush with the inside walls, eliminating accumulation of dust that would be spilled as they are opened. Stainless steel latches are external to prevent corrosive effects of binding; seals are of monocellular neoprene as a precautionary measure against pressure or dust seepage. Three models now available are 200 lb (20 tph capacity), 500 lb (40 tph capacity), and 1000 lb (60 tph capacity).

A FLEXIBLE BUT NON-WOVEN METALLIC BELT for use on drum filters has been perfected and patented, according to The Eimco Corp., P.O. Box 300, Salt Lake City, Utah. The belt is made up of individual rigid, wedge-shaped bars, each bar having several circular eyes. Designed primary for use on EimcoBelt filters, the belt is put together by means of a flexible wire or coil spring strung through the eyes. During cake formation and drying on the filter drum, the bars are close together. This is said to insure a good cake and clear filtrate. When the belt passes around the filter discharge roll, the coil springs flex and because of their tapered shape, the bars spread apart and facilitate cake discharge.

A REGENERATIVE GAS TURBINE ENGINE is being installed for field testing in a truck used for hauling ore at the International Nickel Company of Canada, Limited's open pit mine in the Sudbury District of Ontario. This reportedly will mark the first time that an automotive gas turbine engine has been subjected to the rugged requirements of ore hauling. Called the GMT-305 Whirlfire, the turbine engine was manufactured by the Allison Division of General Motors Corp., Indianapolis, Ind. The 225-hp multi-fuel engine is said to have more than double the power of a comparable piston engine per unit volume and approximately 70 percent more power per pound. Also, the torque characteristics of the dual shaft engine results in a broad horsepower curve which allows the turbine engine to be operated over a wide range of speeds with a minimum loss of power.



A SINGLE-ROLL CRUSHER for reducing friable material, even if it is mixed with noncrushable matter, has been announced by The C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland 5, Ohio. An air-cushioned



breaker bar serves as a release mechanism for foreign bodies in the material, absorbing shock overloads to prevent strain on the wearing parts of the Triumph crusher. Only 15 to 20 hp are said to be needed to power the crusher to handle from six to ten tons of ten lb per cu ft material in an hour. Size of material being discharged can be adjusted while machine is in operation.

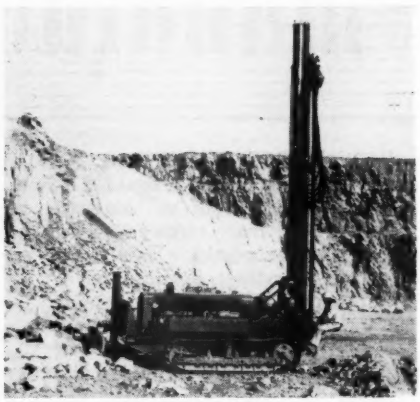


WEIGHING ONLY 18 LB AND NO LARGER THAN AN OVERNIGHT BAG, the "First In" by National Cylinder Gas Div., Chemetron Corp., Chicago, is a small resuscitator claimed to be highly resistant to heat and shock. Said to be operable in any position, it has been developed for rescue work in difficult locations such as shafts, tunnels, vats, narrow passageways or stairs. The entire mechanism can be quickly removed from its aluminum case and carried by handle to its place of need. In addition to use as a resuscitator, in which it automatically inhales and exhales for its user, the unit also serves as an inhalator, supplying a victim steadily with oxygen, and as an aspirator, providing suction to remove obstructing material from the throat. It can be used on-the-spot before victims are moved, or on-the-go as they are being moved.

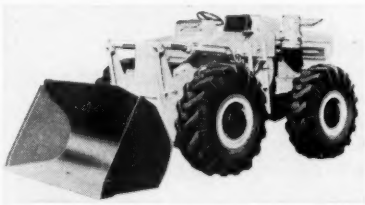
SINGLE-MOTOR TORQUE CONVERTER SHUTTLE CARS with capacities of from 375 to 455 cu ft are being introduced by National Mine Service Co., 2530 Koppers Bldg., Pittsburgh 19, Pa., as a new series designed to haul 15 tons of coal or rock on grades of 25 percent. The 60-in. high, electrically driven TorKar employs a 75-hp motor to power the drive, conveyor and hydraulic pumps. An important feature is an improved braking system with hydraulically-operated geared disc brakes at each of the four wheels that reportedly assures safe stopping even under severe conditions.

A CHAIN CUTTER BIT featuring a wide (¾ in.) nose to allow cutting in rugged conditions is being offered by Vascoloy-Ramet Corp., Waukegan, Ill. Designated as style CHJ, this recent addition to the V-R Red Bit line is for Jeffrey type continuous mining machines. Rigidity is provided by a flange, or collar which seats against the lug and is said to prevent wobbling, carbide breakage, packing of cuttings and to resist side bending. In addition, the bit is locked in place by a retainer pin through a hole in the shank.

A COMPLETELY SELF-CONTAINED SINGLE-UNIT DRILL RIG is the claim made for the Model C42 Crawler Rotadrill by its manufacturer, Schramm, Inc., West Chester, Pa. Drilling equipment, air compressor and drill steel capacity for 60-ft deep holes are all included on a single self-propelled crawler. The rig, designed for one man operation, has all controls for drilling and driving placed in front of a sulky seat mounted on the crawler at the drilling station. It is pointed out by the manufacturer that not only does the operator ride on the rig when moving from hole to hole, he also drills to a depth of 20 ft without leaving the sulky seat. The unit also contains additional lengths of drill steel for deeper drilling.



THE FOUR-WHEEL DRIVE TRACTOR-SHOVELS produced by The Frank G. Hough Co., Libertyville, Ill., and known as the "Payloader," have, according to the manufacturer, been recently provided with numerous performance improving features. Operating capacity of the H-90 series B

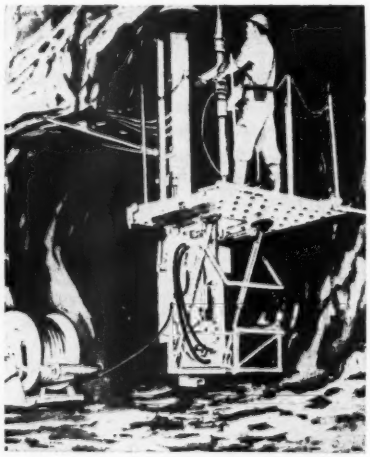


machine remains at 9000 lb but the peak lift has been increased to 18,000 lb. It has a longer wheelbase and wider tread to give better balance and greater stability for operation under adverse conditions. Other new features accorded this vehicle are additional power plus improved power-shift transmission and torque converter.

The H-70 series B payloader boasts a larger diesel engine which develops 124 hp, a peak lift of 13,000 lb, and additional digging power.

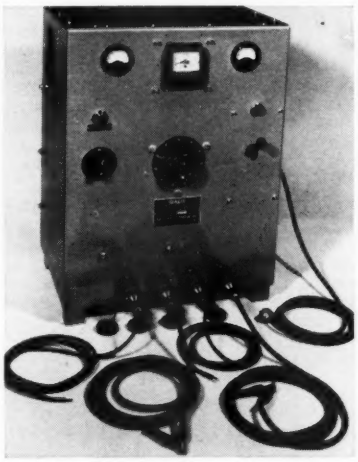
A FULLY-MOLDED, FULLY-JACKETED NOTCHED V-BELT has been announced by Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J. The primary advantages claimed for the "CX" V-belt are quiet, vibrationless running characteristics, ruggedness and greater flexibility, permitting it to run smoothly over smaller pulleys; also, its construction is said to eliminate flex-cracking, and greatly increase fatigue resistance.

A SWEDISH ENGINEERED PLATFORM called the Alimak Raise Climber is now available from the Vulcan Iron Works Co., 2960 S. Fox St., Englewood (Denver), Colo. The unit, said to be fully self contained for driving raises up to 1200 ft or



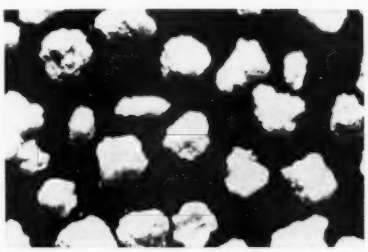
more, consists of rack equipped guide rails which are attached to the shaft or raise wall, a portable all-steel elevator with folding platform and accessory equipment. Lines for air, water, electricity and phone are housed in the guide rails so that one man can perform all raise-driving functions with finger-tip controls.

A PORTABLE POWER PACK with sharply stepped-up current capacity for handling plating work in mining machinery and other fields was recently announced by Sifco Metachemical, Inc., 935 E. 63rd St., Cleveland 3, Ohio. The Dalic unit operates on 220 volts, single phase, 60 cycles; has output of 0-50 amps at 0-30 volts



with stepless voltage control and special amp/hr meter having 0.01 amp/hr divisions. Two positive leads with plugs and two negative leads with clamps permit simultaneous plating and etching operations on two workpieces. The pack is 32 in. high, 24 in. wide, 18 in. deep over-all, and weighs 227 lbs complete with all leads.

AMMONIUM NITRATE IN A NEW PELLET FORM increases the economy and effectiveness of AN blasting, according to Explosives Division, Atlas Powder Co., Wilmington 99, Del. Produced at a new plant recently completed near Joplin, Mo.,



Atlas pellets are described as the optimum size and shape for better control over borehole density and oil absorption. Their reported excellent porosity allows them to readily absorb sensitizing agents such as fuel oil. They are available in 50-lb and 80-lb moisture-resistant bags. The pellets flow freely and may be field-mixed by any method, and are also available in pre-mixed form.

—ANNOUNCEMENTS—

Joy Manufacturing Co., has announced the retirement of its director of advertising and sales promotion, **Roy E. Campbell,** a 31-year veteran with the company, and the appointment of **Robert E. Kinter,** assistant director of this activity to be the new director.

Campbell, a graduate of the University of Washington School of Mines had a considerable background in the mining field before



R. E. Campbell



R. E. Kinter

joining Joy's predecessor company, the Sullivan Machinery Co., in 1929 as core drill contracting manager. In 1933 he assumed duties as advertising and sales promotion manager, and was appointed head of these functions for Joy in 1946. He was among the first publicizers of mechanized mining and was active in professional advertising and publicity organizations. He will retire in California.

Kinter has held many advertising and sales promotion positions with Joy since 1948, was a former divisional advertising manager, and has been assistant company advertising director since 1957. He has also had advertising agency experience and is a journalism graduate of Penn State.

Joy also announces the appointment of **Arnott J. Lee,** district sales manager in the Mining and Construction Division, St. Louis-Chicago territory, to be manager of portable compressor products. He will be succeeded by **Mayo C. Kelley,** who is being transferred from the company's Industrial Division district office in Pittsburgh.

Paul A. Doorley has been named plant manager of **Permali, Inc.,** Mt. Pleasant, Pa., manufacturers of laminated plastic insulation for the railroad, electronic, missile and nucleonics fields. He was formerly executive vice president of the **Connellsville Manufacturing and Mine Supply Co.**

Lake Shore, Inc., has announced the appointment of **John C. Nelson, Jr.,** as production control manager of all marine, industrial and mining equipment manufacture. Nelson will have charge of production schedules for the company's line of mine cars, skips, skiploaders and related items.

Marion Power Shovel Co., has announced the appointment of **A. E. Roberts Jr.,** as manager of its eastern sales district with headquarters in New York City. His territory will include the metropolitan New York City-New Jersey area and the eastern half of New York State.

Spencer Chemical Co., has named two new sales supervisors as part of its newly expanded and streamlined sales program for ammonium nitrate as an ingredient in field-compounded blasting agents. **William B. Macomber** will occupy the post of sales supervisor, Industrial Ammonium Nitrate, and **Charles M. Cooley** will be manager of technical service, Industrial Ammonium Nitrate.

Curtiss-Wright's South Bend Division has announced the appointment of **Joseph Albiez,** a veteran with the company in product and technical sales, as general sales manager, construction machinery.

Reorganization of its Processing Machinery Department with attendant realignment of product lines and the creation of new positions has been announced by **Allis-Chalmers. Frank E. Briber, Jr.,** has been appointed assistant manager of the department and the following key section managerships have also been announced: **C. E. Burnett,** Pyro-Processing; **A. L. Stewart,** Crushing and Grinding Machinery; **J. E. Fink,** Screening Machinery; **H. D. Vanderlip,** Chemical Processing and Food Machinery; and **E. C. Mertz,** Engineering Projects.

Harnischfeger Corp., Milwaukee, has created a new Jackson, Miss., district office to handle P&H construction and mining equipment throughout Mississippi. Louisiana, Arkansas and western Tennessee. **Peter F. Koch,** with the company as a sales representative since 1955, is being transferred from Houston to manage the new district office.

Albert D. Nusser, formerly assistant manager of the Pittsburgh sales branch of **Crucible Steel Co.,** has been appointed by the company to be manager of its New Jersey sales branch with headquarters at Caldwell, N. J.

(Catalogs & Bulletins next page)

CATALOGS & BULLETINS

SLUSHERS. *Joy Mfg. Co., Oliver Bldg., Pittsburgh 22, Pa.* The company now has two bulletins describing its line of lightweight air and electric driven slushers. Bulletin 76-F covers the five-hp model S-211 which has an 1100-lb rope pull and measures 27 by 21½ by 14½ in. Bulletin 76-G tells of Model FF-211 with ratings of 7½, 10 and 15 hp, and a maximum (rated) pull of 2500 lb. It comes in two and three-drum versions with respective lengths of 39½ and 51 in. with short length motors, respective widths of 25 and 29 in., and a height of 23 in.

TEN MAINTENANCE STEPS. *Cummins Engine Co., Inc., Sales Service Dept., Columbus, Ind.* Cummins' booklet on diesel engine maintenance is organized in ten chapters to cover the ten maintenance steps the company believes necessary to increase equipment availability, reduce operating costs and obtain better engine performance.

ROTARY COMPRESSOR. *Davey Compressor Co., Kent, Ohio.* Form E-263, which describes the Model 600 RP rotary compressor, covers the operating principles employed in the Davey multiple stage rotary compression system and emphasizes the patented Davey "Perma-Vane" blades. Model 600 delivers 625 cfm at 100 psi.

ROLLER CHAINS AND SPROCKETS. *Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill.* Book 2757 lists and describes over 2000 types and sizes of stock roller chains and sprockets including standard and double pitch power transmission chains and a large selection of conveyor chains and attachments.

USES OF STEEL CASTINGS. *Steel Founders' Society of America, 606 Terminal Tower Bldg., Cleveland 13, Ohio.* "Sinews of Modern Living" features the use of steel castings in the mining industry and is graphically illustrated by line drawings of more than 200 representative steel castings. Copies of the booklet may be obtained from member companies of SFSA. For a list of member companies, write to Steel Founders' Society of America.

PERSONNEL FILE FOLDER. *Aptitests, 31 South Carpenter Ave., Indiana, Pa.* Literature describes Aptitests' Personnel File Folders which are designed to provide a compact, permanent data file on job applicants and employees. The folder incorporates a standard employment application and will fit standard correspondence size file drawers.

CONSTRUCTION MACHINERY. *Allis-Chalmers Mfg. Co., Construction Machinery Div., Milwaukee 1, Wisconsin.* Four pieces of literature now available are: MS-1357, reviewing the recently introduced 340-hp, 30-yd heaped, TS-360 motor scraper; UT-116, giving an illustrated story of Allis-Chalmers D-10 and D-12 utility tractors; MS-1319, a revision of a previous catalog covering the Model D motor grader; and MS-1322, covering highlights of engineering, design and construction features of Allis-Chalmers TS-160 motor scraper, the 155-hp, 9.5 cu yd heaped capacity unit.

HYDRAULIC TESTER. *Schroeder Brothers Corp., Box 72, Nichol Ave., McKees Rocks, Pa.* Means and methods for using a 19-lb portable hydraulic circuit tester are described in the bulletin entitled, "Track Down Hydraulic Troubles." It outlines maintenance methods mechanics should follow when trouble-shooting hydraulic systems, when testing before and after rebuild and for performing preventive maintenance tests.

CRAWLER EXCAVATOR/CRANE. *American Hoist and Derrick Co., 63 South Robert, St. Paul 7, Minn.* The American 200 Series Crawler Excavator/Crane is described and illustrated in catalog No. 720-CG-3. The machine's versatility is shown on many different type jobs such as crane, magnet, clamshell, dragline, shovel and backhoe.

FORGED-STEEL MINE CAR WHEELS. *Bethlehem Steel Co., Publication Dept., Bethlehem, Pa.* Four-page booklet tells how Bethlehem forged-steel mine car wheels speed haulage, increase mine safety and reduce maintenance.

Index to Advertisers

ACF Industries, Inc., 15
American Car & Foundry Div.
Acme Machinery Co., 4
Allis-Chalmers, 6
American Mining Congress, 65
1960 Mining Show
Atlas Copco, 27
Atlas Powder Co., 72
Explosives Div.

Bethlehem Steel Co., 5
Bowdil Company, 22-23
Brook Motor Corp., 78
Bruns Coal Co., 82

Caterpillar Tractor Co., 16-17
Centrifugal & Mechanical Industries, Inc., 83
Colorado Fuel & Iron Co., 25

Deister Concentrator Co., 54
Denver Equipment Co., Inside Front Cover
Dowty Mining, Ltd., 10

Euclid Division, 14
General Motors Corp.
Exide Industrial Div., 75
The Electric Storage Battery Co.

Flexible Steel Lacing Co., 75

General Cable Corp., 30-31
Gerow, Theron G., 81

Hendrick Mfg. Co., 85
Hendrix Mfg. Co., 28
Heyl & Patterson Co., 82

Ingersoll-Rand, Inside Back Cover

Jeffrey Mfg. Co., 20-21

Lee-Norse Co., 7
LeTourneau-Westinghouse Co., 8-9, 11
Long-Airdox Co., 26
Div. of Marmon-Herrington Co.
Longyear Co., E. J., 37

Mine Safety Appliances Co., Back Cover
Mott Core Drilling Co., 81

National Mine Service Co., 24

Ohio Brass Co., 29

Pattin Mfg. Co., 84

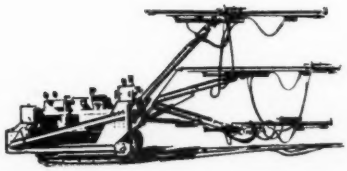
Roberts & Schaefer Co., 2
Roebling's Sons Div., John A., 71
The Colorado Fuel & Iron Corp.

Sanford-Day Ironworks, Inc., 80
Sheffield Div., 12
Armco Steel Corp.
Sprague & Henwood, Inc., 88
Stearns-Roger Co., 32
Stratoflex, Inc., 87

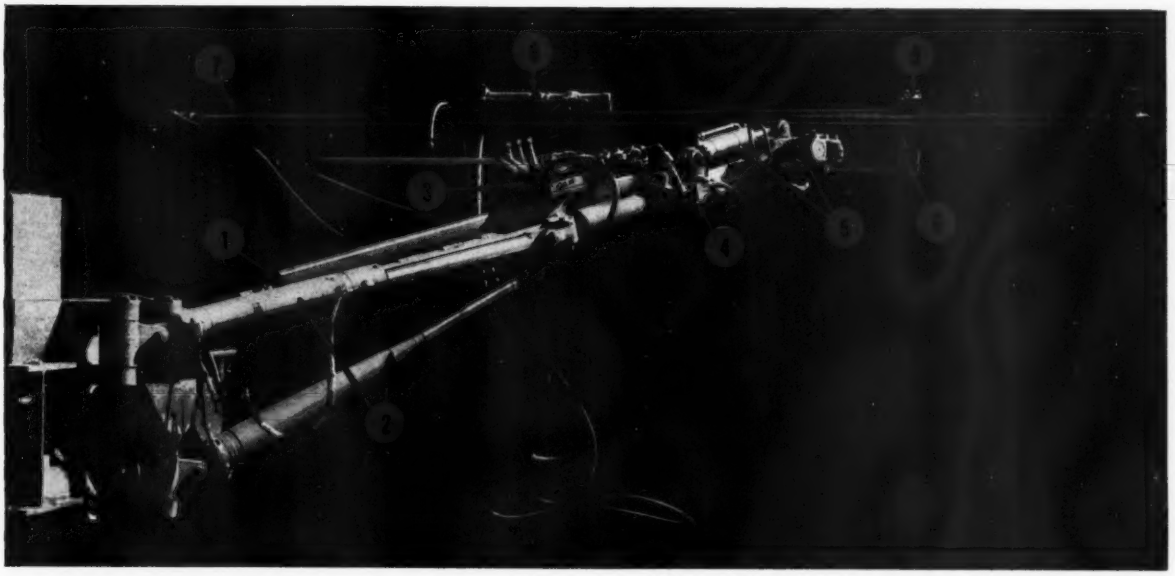
Thor Power Tool Co., 3
Timken Roller Bearing Co., 13

Union Wire Rope Corp., 18-19
U. S. Rubber Co., 79

Woomer & Associates, 81



Here's Why HYDRA-BOOMS make BETTER JUMBOS



Ingersoll-Rand Hydra-Booms are hydraulically-operated drill mountings that are designed and built not only for greatest ease of operation, but for maximum *safety* and *dependability* as well. Check and compare these Hydra-Boom features – then make sure your next jumbo has all these advantages for faster, safer drilling.

1. **HOSE SHIELD** welded to boom, protects air and hydraulic hoses against damage. Simpler, neater and safer.
2. **SAFETY-LOCK CYLINDERS** – big, powerful, double-acting for fast operation in either direction. Safety-lock check valves prevent creeping or dropping of booms.
3. **BOOM-MOUNTED OR REMOTE CONTROLS** – can be mounted wherever desired. For fully centralized operation, they can be combined with remote drill controls.
4. **HYDRAULIC JUNCTION BOXES** – short hydraulic connections from end of boom simplify replacement in case of wear or damage.
5. **POWER DUMP & SWING** – separate cylinders move drill guide to any position at the touch of a control valve.
6. **PROTECTIVE SHIELD** over end of drill-feed extension cylinder prevents damage to the hydraulic connection—otherwise a vulnerable spot.
7. **SCREW OR CHAIN FEEDS** – Ingersoll-Rand can supply reversible aluminum-shell screw feeds from 30" to 144", as well as air-driven chain feeds to any practical length.
8. **FULL LINE OF HEAVY-DUTY DRIFTERS** – with the right combination of weight, power and bore size for any application.
9. **TRAVELING CENTRALIZER** prevents whipping and fatigue of drill steels, assuring substantially longer rod life.

In addition, Ingersoll-Rand has pioneered in the development of the following equipment for tunneling and mining jumbos and can meet your exact requirements for any job.

BURN-CUT "PACKAGE" – Ingersoll-Rand Downhole Drill, air-powered rotary head, chain feed and large-diameter Carset bit for drilling a central burn cut. Permits pulling longer rounds and gives improved fragmentation with less powder.

AIR PREHEATER – Specially designed electric heating units pre-heat the drilling air, eliminating fogging at the work face, promoting safer working conditions and providing better drill lubrication.

Ask your Ingersoll-Rand engineer for complete information.

Ingersoll-Rand

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A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK



Here, the THRU-STEEL Dust Collector is mounted on a continuous miner. Roof bolt drills and dust collectors on both sides of the machine help keep roof bolting up to or ahead of the miner.

For maximum efficiency

New M-S-A® Collector sucks dust through drill steel —speeds roof bolting, improves safety

The M-S-A® THRU-STEEL* Dust Collector helps keep roof bolting up to or ahead of the mining cycle.

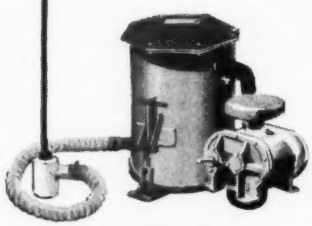
With old style collectors, time wasting set-ups are necessary to raise the dust collecting head against the roof. Not so with THRU-STEEL Collector. Collector cup and jack assembly are eliminated. Dust is sucked into the tubular drill steel through narrow slots below the bit, and quickly conveyed through the drill steel to the collecting tank. Smooth round drill steel, used with this system, is easier to handle than scrolled augers. Steels can be added and withdrawn easier, faster, and more efficiently.

THRU-STEEL Collector assures safe, proper dust control because bolt hole drilling and dust collecting operations are integrated. Cleaner, safer working conditions, with better visibility result. Drill steels are safer to handle. No scrolls to snag gloves, sleeves, or clothing.

The M-S-A® THRU-STEEL Dust Collector installs on any roof bolting machine or continuous miner equipped with roof drills. Various lengths of drill steel make it adaptable for high or low seams. If you have the M-S-A® Bolt-Hole Cleaner, it can be converted to a THRU-STEEL Collector easily, inexpensively. Call your MSA Representative for all the facts, or write us for bulletin.

*Trademark

This is the THRU-STEEL system. It consists of the bit, drill steel, chuck adaptor, rectangular or cylindrical collecting tank, vacuum pump, relief valve, and silencer.
USBM Approved



MSA
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